# The Electrical Review

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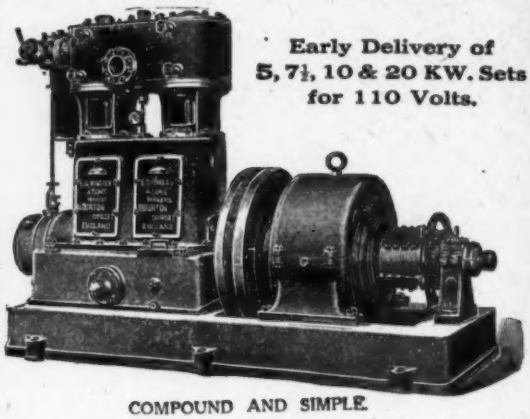

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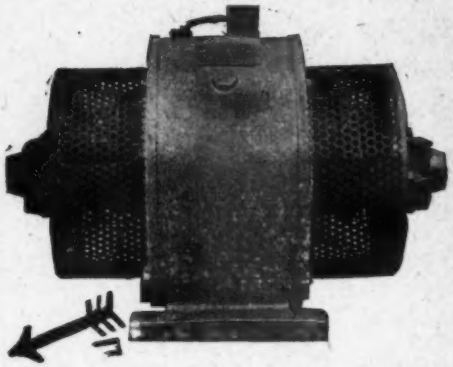

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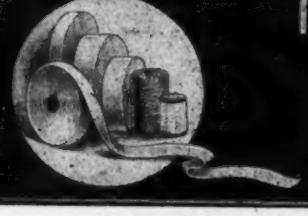

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VOL. LXXXIX. JULY 22, 1921. No. 2,278

## ELECTRICAL REVIEW.

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## THE RUBBER INDUSTRY.

THE position of the rubber-growing industry is reaching a climax following successive attempts to bring about stabilisation, none of which has attained any real success. Towards the end of last year the members of the Rubber Growers' Association (which includes most of the large British-owned Eastern estates) agreed voluntarily to reduce their output to 25 per cent., and although this understanding was loyally adhered to, the surplus rubber in existence to-day is greater than it was then. There are now between 70,000 and 80,000 tons stored in New York, and something like 78,000 tons here, while it is estimated in directions which should be well-informed, that the stocks available for shipment in the East are about 100,000 tons. In order to put the trade on a better footing the Rubber Growers' Association has now formed the Rubber Producers' Corporation, with the object of controlling the rubber output of its members, fixing the selling price and regulating the sale of such rubber, controlling the opening up of fresh rubber plantations by its members, and generally of assisting to finance the stocks of its constituents. As the Corporation is concerned only with British-controlled plantations, it is proposed that a similar Corporation be formed simultaneously to include estates owned by Dutch interests and by companies or individuals in the Dutch East Indies, a working agreement being entered into between the two Corporations, to ensure uniformity of action. The Rubber Producers' Corporation will not go to allotment until the owners of at least 2,200,000 acres, inclusive of the Dutch Corporation membership, have agreed to come into the scheme. The capital of the British end of the organisation will be £2,000,000, with borrowing powers either on debentures or otherwise up to £8,000,000, of which at least £3,000,000 is to be raised in the first instance.

There is no doubt that part of the demoralisation recently seen in the rubber market is the aftermath of excessive optimism on the part not only of producers but also of consumers, certain of the latter, indeed, having enormously over-bought themselves, and having been compelled to throw their holdings on the market, in addition to which there has, of course, been inevitable speculation for the rise which has involved very heavy losses. Whatever the result of the proposals now put forward, it must be remembered that the restriction of output can be merely a temporary palliative, but, on the other hand, if the restriction were entirely voluntary and left to the judgment of each individual producer, there could be no effective stabilisation, because as the price rose to a profitable level, over-production would again result, with its inevitable consequences. As it is, a considerable area of the rubber estates in Malaya consists of small holdings owned by Chinese and others, who will probably be outside the operation of any restrictive covenant amongst the British-owned concerns, and these might easily become thorns in the flesh, the removal of which would present difficulties.

It is the considered opinion of the trade that any material and early expansion of demand is out of the question. The existing world stock is somewhere about 300,000 tons, the potential output in 1922 is over 400,000 tons, and the potential consumption is this year unlikely to exceed 250,000 tons. It is quite clear, therefore, that if anything is to be done effectively the time is fully ripe for action. The slump in prices has been prolonged and severe, and it is reasonable to believe that with selling prices so far below cost, a reaction must be seen sooner or later, but meantime, producing costs have no

significance, where holders are compelled to liquidate their stocks or their commitments, and it is only by concerted action of some kind, artificial though this may be, that selling prices can be put on a more satisfactory basis. Under any circumstances the stabilisation of the rubber market must prove a long and painful process, though by the efforts of the new organisation it may be possible somewhat to advance the selling price, and to impart a degree of stability to which the market for some time has been a stranger.

**A National Electrical Convention.**

On Wednesday the annual meeting of the I.M.E.A. was opened by Mr. H. Richardson, and having listened with interest to his presidential address, we are in a position to congratulate him upon the admirable views which are embodied in it. There is not a sentence with which we do not cordially agree, and we trust that it will be widely read and laid to heart by all who are interested in the development of the electricity supply industry. While we know that there are many amongst the ranks of municipal engineers who are wholly free from prejudice against private enterprise, it is refreshing to hear the President of the Incorporated Municipal Electrical Association appeal for closer co-operation between municipal and private enterprise, and deprecate the unjust attacks which are too often made upon the latter.

The subject, however, to which Mr. Richardson devotes the greatest space is one which we, as he says, have dwelt upon, and to which we again drew attention on two occasions recently—namely, the promotion of a great annual Convention of the whole of the electrical Associations in the kingdom, similar to that which has so often excited our envy, in the United States. True, we cannot hope to rival the N.E.L.A. Convention in magnitude; we must be content to work on a smaller scale—but we can rival our American cousins in efficiency, zeal, and enthusiasm, and the success of such a venture need not be held in doubt.

Mr. Richardson quite rightly suggests that the Institution of Electrical Engineers should be the first body to be approached in the matter; since it developed a progressive spirit and proved its readiness to adapt itself to modern conditions, the Institution has gained immensely in efficiency and prestige, and has definitely assumed its rightful position as the leading electrical society in this country. But as the President surmises, the organisation of the National Convention would be a heavy addition to the burdens of a Council and staff that are already overworked, and as we have previously indicated, we think, with the President, that the British Electrical Development Association is admirably adapted to take charge of the movement—a movement which is entirely within its special sphere. In saying this we have in mind one aspect of the Convention to which Mr. Richardson alluded, and on which we have laid stress—the educational side of the function in the public eye. Undoubtedly the value of the Convention as a first-class propaganda would be enormous, and the lay Press would be aroused to a degree of interest and appreciation far beyond anything yet achieved by any electrical gathering in this country. But we do not lose sight of the strong attraction that such a Convention would hold out to the whole of the industry as a unique opportunity for meeting everybody, and discussing everything, in the electrical field. It would be the event of the year in electrical circles, and it would do more than any other means to foster close co-operation between all branches of the industry.

We earnestly hope, therefore, that the seed sown by Mr. Richardson will bear fruit, and that all parties will receive the proposal with cordial approval. The sooner action is taken the better, for it is not a day too soon to commence the work of organisation if the first Convention is to be held next year. We understand that it is the intention of the "Beama" to hold an electrical exhibition in 1922, if possible, and if the Convention can be held at the same time and place, so much the better.

**Currency and Credit.**

In its resolution forwarded to the Government, the Credits and Currency Department of the Federation of British Industries asks for a new commission on currency and credits, in order that the present situation may be examined in the light of recent events. It points out that since the late Lord Cunliffe's Committee reported there have been important changes in our circumstances.

In the first place the exchanges were artificially controlled during the War, with the result that the European exchanges in terms of dollars have depreciated in certain cases to such an extent that it is impossible to expect a recovery to pre-war levels within a decade. Consequently it is pointed out that there is no sign that any of the nations of Europe are really willing to face the enormous sacrifices involved in the general adoption of the currency policy. On the contrary, producers in most European countries are successfully bringing strong pressure to bear upon their Governments to prevent any attempt at an improvement in their respective rates of exchange. Foreign manufacturers, especially Germans, see clearly enough the enormous advantages to them of keeping their own rate of exchange as low as they possibly can. Those people in this country who sometimes rejoice when they see a slight improvement in our rate of exchange, do not seem to realise that every one per cent. that our exchange goes up, makes it one per cent. more difficult to sell anything abroad.

The Federation of British Industries further points out that through the years 1919-1920 an upward movement of prices continued to a lesser or greater extent in all European countries, and in most of them a continued inflation of the currency took place. Consequently, the distance to be travelled before they can return to their pre-war gold currency is very much greater than it was at the time of the Cunliffe Report.

The last point touched upon is the enormous increase in the burden of taxation, and the fact that any attempt to repay in to-day's currency debts incurred at the pre-war level is practically an impossibility.

A more detailed memorandum is to be forwarded to the Government in due course, in the hope that a new Commission will be appointed before the close of the present Session. It seems to us that if a new Commission is to result in anything being done to improve conditions for British traders its composition will be a difficult affair. Any more of the pious aspirations embodied in the report of the Cunliffe Committee would be absolutely useless, and unless men can be selected with new ideas, who are prepared to recommend something practicable to help the manufacturer and the trader, the Committee might just as well not be appointed.

**The Buenos Ayres Electricity Works.**

The report of the Compania Hispano-Americana de Electricidad, of Madrid, which acquired the works of the German Transmission Electricity Co. at Buenos Ayres and the interests held by the latter in other undertakings in South America, contains a statement which reveals the fact that Belgian technical advice has now replaced German in connection with the development of the undertakings. The directors state that their principal preoccupation from the time of the transfer in July, 1920, was not only to continue the management of the business, but also to develop it, and they proceeded to prepare a scheme of renovation and extension which had become necessary during the years of warfare. It was soon possible to proceed with the execution of the scheme, thanks to the co-operation of the Société Financière de Transports et d'Entreprises Industrielles, of Brussels, to which the directors entrusted the realisation of the investigations and works of a technical kind. Among the works in progress or completed are mentioned the provision of two turbo-alternators of 20,000 kW and 50 periods, one of 20,000 kW and 25 periods, and three of 6,000 kW, the modification of the main switchboard at the South Docks station, Buenos Ayres, and other works.

# THE CO-OPERATIVE SYSTEM OF ENGINEERING EDUCATION.

By E. KILBURN SCOTT.

Some professors and teachers of engineering believe that it is possible to give sufficient practical instruction in engineering in what may be called "school workshops." Such workshops usually contain a number of more or less obsolete machine tools, one or more smith's hearths, and the usual benches for fitting, pattern-making, &c. There may also be some attempt at making small brass and iron castings. However up-to-date such a workshop is when first equipped, it soon falls behind the times because of the quick progress of engineering development. Commercial engineering becomes more and more concerned with the manufacture of large quantities of apparatus requiring special automatic tools, and a great deal of the most important work is structural steel, chemical machinery, mining apparatus, &c., which has to be built on a large scale.

For the above and other reasons, many believe that practical engineering training can only be properly acquired in industrial workshops, and that the school workshops are only useful for giving preliminary instruction in the use of hand-tools and to teach young men how not to injure themselves when handling machinery, belting, gearing, &c.

The question is: What is the best method of co-ordinating the theory and principles taught in engineering colleges and technical schools with the practical experience that can only be properly acquired in real engineering workshops?

It is clearly desirable that students should take a course in practical engineering at the same time that they are doing theoretical work, and for this reason it is customary for some university students to voluntarily spend part of their vacations in workshops.

The sandwich system whereby students spend half of the year in college and half in works has been very successful, and it is interesting to note that a somewhat similar method is very successful in the United States. It is known as the *Co-operative System*, and it is the purpose of this article to describe it.

It was first started at the University of Cincinnati in 1906 by Prof. H. Schneider, Dean of the College of Engineering, and consists of two groups of engineering students spending fortnightly periods in industrial works of Cincinnati and intervening fortnights in the class-rooms and laboratories of the College of Engineering. The two groups change and change so as to give continuous training.

Prof. H. Schneider saw that such a system would enable many worthy young men to obtain instruction at the Engineering College who otherwise would be excluded, for the main idea of the course is to enable a student to earn sufficient money to keep himself and pay his class fees, whilst at the same time acquiring workshop experience and theoretical instruction under the very best conditions.

When the plan was first mooted to the University faculty it met with scepticism, as it was said that a group of "boiler makers" would soon destroy the scholastic atmosphere of the University, but opposition was broken down by Prof. H. Schneider proving that many practising engineers and managers of industrial concerns of Cincinnati viewed it favourably. They expressed belief in its feasibility, and were unanimous in saying that their theoretical training had meant little to them upon graduation, because they lacked practical knowledge.

The officials of a large bridge-making corporation gave hearty endorsement to the co-operative plan, both as an educational and a commercial proposition, and when the plan had been explained to the superintendents of departments and foremen of workshops, they also showed interest. Finally, twelve concerns engaged in electrical and mechanical engineering agreed to try the co-operative system.

The arrangement of the alternating periods proved to be a matter of mere administrative detail, the only change suggested being to make each period a fortnight instead of a week.

The next problem was to find students who would take the co-operative course, for those who came to take the regular four-years' course could not be induced to try, because of the requirement that they should spend the summer in the shops. This requirement discouraged many prospective members of the first group of co-operative students; for ten hours of manual labour in hot weather, and on equal terms with ordinary apprentices, is a pretty severe test.

To fill their place Prof. Schneider hurriedly recruited a class of young men who had failed to obtain the full academic units required for admission to the college, but who had had some practical experience and gave evidence of fitness for engineering work. Notwithstanding their rather poor scholastic records, the members of this first class were promising, and caught the spirit of the new course. One of them is now efficiency engineer for the Bell Telephone Co., in a Middle-West State, and he was admitted against the advice of his father and over the protests of three high-school principals, who had dismissed him as incorrigible.

Once the system was proved a success, progress was very rapid, and many thousands of young engineers in Ohio and neighbouring States owe their start in engineering to this co-operative training, and the College of Engineering at Cincinnati is now one of the largest and most successful in the country.

It has been found that interlinking practical work and theoretical studies closely for five years enables young engineers to acquire a thorough acquaintance with practical engineering conditions, and on graduation they are able to at once undertake positions of responsibility. The co-operative system has an improving influence on character, and develops industry, loyalty, and self-reliance, because the students are earning money all the time they are learning.

The young men obtain such excellent first-hand information of workshop processes, &c., that the College can concentrate on theory and principles, with the result that the theoretical training is very complete. Continuous experience in theory and practice enables students to find their special forte very quickly, and there is less chance of misfits in after life.

The first groups of co-operative students developed great responsibility, because they knew the outcome of an important educational experiment depended upon success, and the realisation of this fact seemed to give a sense of loyalty to the college, and a determination not to disappoint those who had trusted them.

They were self-conscious owing to being the centre of interest in the educational clinic, and the knowledge that they were being analysed and written up gave them a feeling of aloofness from the rest of the students.

At first there was class consciousness, caused by the exclusive attitude of the regular academic students, but the animosity between the two groups soon disappeared, and co-operative students and others have found that they have a great many things in common. The fact that their interests and experiences are in some respects unlike has made their association mutually beneficial.

Co-operative students take a prominent part in every kind of student activity. Three have been elected to the presidency of the senior class, and the captains of both football and basketball teams are "co-ops." In all musical, social, and other organisations there is a large proportion of co-operative students, and in view of recent developments, it would be hard for either group to

understand that the "ostracism of the boiler makers" was once seriously considered.

The co-operative student is alert, rugged, and independent, more serious than the "regular" student, and yet on occasion displays a sense of humour and a buoyancy which shows that the sobering of practical work does not depress him.

The latest development in co-operative instruction at the University of Cincinnati has been the merging of the College of Commerce with the College of Engineering. This has opened up many new opportunities for the further usefulness of the co-operative system, for students of commerce spend alternate bi-weekly periods in the business departments of various firms in the Cincinnati area, and thus gain first-hand information regarding the application of their studies under commercial conditions. A feature of the new course is that during the first two years the same fundamental training and same industrial contact are given to both commercial and to engineering students.

To summarise, the "co-operative system" may be said to be a co-ordination of theoretical and practical training in a progressive educational programme, the agency which furnishes the practical experience being always some branch of actual industry, thus giving the fullest possible utilisation, for educational purposes, of equipment used in commercial production.

From the employer's point of view, the most important elements of the co-operative plan are the proper selection of workers, and the awakening of an enlightened interest in their work through co-ordinated instruction. From the standpoint of the school and the student, the important feature of co-operative education is the realisation of theory through its practical applications. In a very literal sense the studies become "applied subjects," and in the word "co-operative," emphasis is placed not only on the kind of training, but also on the relation between school and industry, and the method of bringing them together.

Co-operative engineering graduates have become a factor in engineering circles of the United States, for not only are they being trained at Cincinnati, but also at the University of Pittsburg, the Municipal University of Akron, and the Georgia Institute of Technology.

A report recently published, based on an investigation of engineering education in the United States, by the Carnegie Foundation, strongly endorses the co-operative system.

In a number of high schools the co-operative plan has also been adopted, and courses have been operated successfully under widely varying conditions. Thus at Fitchburg, Mass., high school students, after spending one year *wholly* in the school, go to work during alternate weeks as apprentice machinists, pattern makers, saw makers, draughtsmen, moulders, tinsmiths, printers, or textile workers. The instruction which they receive at school is co-ordinated with their practical work.

The co-operative system is similarly applied in a Pennsylvania high school, where students work in machine shops, foundries, automobile and carriage works, and in the cabinet-making department of a piano factory. Recently co-operative courses have been introduced into several high schools in New York City, and co-operation is carried on with machine shops, railroads, automatic factories, printing offices, electric light and power companies, mail order houses, and department stores. The results of the New York experiment have refuted arguments that the co-operative course can only succeed with a few occupations, and in small centres of population.

## THE ELECTRIC WASHING MACHINE: FROM THE HOUSEWIFE'S POINT OF VIEW.

By MARY GWYNNE HOWELL.

With the present high prices of the commercial laundries, and with the servant shortage, there should be a big demand for electric washing machines. That they are not universally popular in this country is due as much to the fact that their possibilities are not understood by the firms that sell them as to the timidity on the part of the housewife to invest in something so new and untried.

If a woman is attracted by a window display and makes inquiries as to the method of using a washing machine the following directions are given: "Fill the machine to the water line with *very hot water*, add soap, put in the clothes, turn on the switch, and, hey presto! the clothes will be washed clean without any further attention.

This sounds very alluring, but if the prospective purchaser happens to be a practical housewife, she begins to ask detailed questions, which can only be answered by one who understands the processes of laundrywork, at least in theory. No really practical woman can be convinced, for instance, that if she plunges her woollens and flannels into the very hot water directed to be used there is sufficient magic in the washing machine to prevent the possibility of their shrinking! Many such points will arise, and it is because the directions are so misleading that people are sceptical as to the powers of the washing machine.

As a matter of fact, an electric washing machine used in the proper way has far more merits than are usually advertised, and armed with the necessary information, a salesman could easily convince a progressive housewife. The true facts, as tested by domestic science experts, both in the United States and in this country, are these:—

1. *The clothes do not need any soaking overnight.* The machine is capable of flushing out the dirt without this preliminary process, and much better results are gained if the clothes are put into the machine dry.

This point will appeal to the housewife, since it saves her much time and trouble.

2. *The water in the machine should only be warm*—not very hot.

The fallacy of very hot water has arisen from the fact that when a test wash is carried out at the factory, the garments washed are workers' greasy overalls—the grease being mineral oil. It is true that very hot water dissolves and removes mineral oil, hence the directions. The housewife, however, has to deal with garments soiled with animal fats and grease, and the albumen in animal fat *coagulates with heat*, with the result that the dirt is set fast.

This is the reason why wristbands, collars, and cuffs, and very soiled parts are often still grimy after a machine wash.

Not only does warm water give better results than hot, but it is also a matter of economy in hot water, which again will appeal to the housewife.

3. An important factor in machine washing is the use of really efficient soap *in solution*, together with a little water softener (soda or borax).

It is most important that the water should be soft and foamy with soap before the clothes are put into the machine. Proportions will vary according to the hardness of the water, but as a guide a general proportion of half a pint of soap solution (a breakfast cupful) and half a cup of strong soda solution can be given.

4. The clothes should be sorted into "loads," care being taken not to overcrowd the machine. It is far better to divide a big heap of clothes into two smaller loads, washing each for 15 minutes, than to crowd them all in at once and risk injury to the garments and strain to the machine.

5. Fifteen minutes in the machine should cleanse any but very soiled garments (which will require 20 to 30 minutes). After washing, each garment should be put through the wringer and left until all are finished.

The water does not need changing for each load of clothes, but only when it is really dirty, and the soap has disappeared.

6. The method of rinsing is most important. White clothes should be rinsed in *scalding hot water*, in the machine, running for five minutes.

This simple process does away with the necessity for *boiling*, and will be the most appreciated of all the virtues of machine washing.

Coloured materials and silks need warm water for rinsing. Flannels and woollens need warm, slightly soapy water.

An understanding of all these points will greatly enhance the value of a washing machine in the eyes of a would-be purchaser.

As with all machinery, there are important details as to the care which will make all the difference to the working efficiency of the machine.

These points are not understood by the average housewoman, and therefore a wise salesman will impress them upon a purchaser:

1. The moving parts require frequent lubrication. A woman who has had nothing to do with machinery would not think of oiling the machine unless told to do so.

2. The machine must be thoroughly rinsed and dried after each use, but *not scoured*. If the interior is galvanised a whitish-grey deposit gradually collects as the result of a chemical reaction due to lime and magnesia salts in the water combining with the soap. This coating in not harmful—in fact it protects the metal from further chemical reaction, and should be left alone unless it becomes too thick.

3. Care must be taken that the connecting cord is not permitted to lie on a wet floor. When not in use it should be coiled carefully without knots or twists. The plug should never be jerked from the socket by means of the cord.

A practical woman having been shown in full the advantages of home washing with an electric machine should need no further persuasion; but should the price prove a stumbling block, a telling argument can be introduced in the fact that a reliable make of modern washing machine is constructed of such lasting materials that, given common sense care and treatment, it should last at least 20 years. This being so, the cost can safely be calculated on the basis of a 20-years' investment, and as such, proving the machine to be an inestimable bargain. Few women who have experienced the toil of washing by human power will be proof against such arguments.

# THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

## ANNUAL MEETING.

THE annual meeting of the Association was opened on Wednesday last at the Institution of Mechanical Engineers, the I.E.E. building being still occupied by the inquiry which the Electricity Commissioners have in hand with regard to the London electricity supply. There was a large attendance of members from all parts of the country, and while the usual civic reception was lacking, there was otherwise no great difference between the proceedings and those which characterise the annual conventions of the Association. The meeting, however, commenced in the afternoon, instead of the morning, and there were no social functions or organised excursions, the only break in the labours of the members being made by the annual dinner on Thursday evening, for which some 200 tickets have been taken.

The meeting was opened by the President, Mr. H. Richardson, F.R.S.E., general manager and engineer, Dundee, who delivered his address; afterwards Mr. C. W. Charlesworth (Wolverhampton) read an exhaustive paper on "Questions arising in the consideration of the financial and business aspects of municipal electricity supply." A meeting of the chairmen members of the Association followed.

Yesterday the programme provided for the reading and discussion of three papers: "Steam raising—yesterday, to-day, and to-morrow," by Mr. D. Wilson (Messrs. Babcock & Wilcox); "Modern boiler-house practice," by Mr. W. M. Miles (Sheffield); and "Present-day commercial problems in electricity supply," by Mr. E. Cross (Rotherham).

The annual general meeting was to be held this morning, and a meeting of the Associated Municipal Electrical Engineers (Great Britain and Ireland) at the same place this afternoon.

### Presidential Address.

By Mr. H. RICHARDSON,
General Manager and Engineer, Dundee. (*Abstract.*)

The Association continues to flourish exceedingly; it now represents a capital sum, due to municipal electrical development, of almost £80,000,000 and a total revenue of practically £20,000,000 per annum.

A little over a year ago many were full of hope as to the great strides which were to be made in the direction of a cheap and abundant supply of electricity all over the country, and seemed to hold the opinion that the Electricity Commissioners would at once cause difficulties and obstructions to vanish, when each and every power supply authority whether municipally or company controlled, would be given freedom to attain its individual ambitions. When the obvious results of any constructive organisation became apparent, however, many of these entities felt that it would have to be a case of self-immolation for the benefit of the multitude, and are now betraying a sudden preference for a conservative maintenance of the *status quo* rather than wholeheartedly to join in a collective effort which cannot fail to be eventually of great benefit to the community.

There appears to be a lack of co-operation between municipally controlled undertakings and those which have been built up under private enterprise, which is not justified. Both are necessary, to obtain the maximum benefit for the public. The old difficulties have vanished, and the interests of municipalities and companies are very much more parallel and allied than many appear to think. Although the opinion that municipal concerns cannot work as cheaply as those run by companies is, to an extent, true, yet the companies should give full credit to many municipal electricity authorities which have been noticeable successes.

The reiterated accusations against private enterprise which insist that industries financed by private bodies make large profits and generally batten upon a helpless public, are not borne out by the facts of the case as I see them. Indeed, I would go further, and state that it would have been impossible to develop the electrical industry to the extent it has been developed had it not been for the risks taken and losses experienced by companies and their shareholders in the early days of electricity supply.

Even to-day it is an outstanding fact that we have to rely for the necessarily expensive stages of experiment and initiative on those concerns owned by companies; the records for cheap electricity supply in this country are held by supply companies, and there is no evidence to show that, generally speaking, the charges made by them are in excess of those made by municipalities. In the United States of America, where energy is sold comparatively as cheaply as it is sold in this country, the supply is almost entirely in the hands of private enterprise, and the development of the uses of electricity has been much more intense and the benefits to the public have been greater and more rapid than on this side.

Under modern conditions municipalities will have to adopt a more liberal view in the methods of developing their trading departments if they are going to maintain their hold upon such a vast industry as the power supply of the immediate future must become. I am so anxious to see municipalities maintain a high standard of public service of electricity, with more rapid development, that I cannot refrain from pointing out the dangers of the continued parsimony of view which has recently been apparent.

Great as is the support the Electricity Commission deservedly enjoys, to be useful it must be practical. The Commissioners have set to work to mark out the road of our future progress. It can only do good and strengthen their confidence in them-

selves and their work if we loyally and continuously let them feel that they have our enthusiastic and active support. I earnestly trust that chairmen and managers of both company-owned and municipally-owned concerns will use their undoubtedly powerful influence with their authorities to smooth away apparent obstacles or obstructions to recommendations the benefits of which may not be immediately forthcoming.

Managers and engineers of electricity supply authorities never had a better opportunity than the present for arriving at a practical basic principle of charging for electricity. Nothing can be clearer than the necessity for a simple charge for all purposes made up of a standard or service charge graduated according to the practical demand of the consumer, and, in addition, a certain rate per unit for all energy consumed. I hope this method, already placed before the Commissioners, will receive their approval at an early date, and having been adopted, let all resist the temptation to handicap the system with irritating and unnecessary complications.

I would take the opportunity of expressing the hope that every possible encouragement will be given by the Commissioners to the development of water power in this country. I have formed the opinion that many of us have greatly underestimated the possibilities of the country in this direction.

Owing to the large capital cost, however, there is a tendency for municipalities to avoid the responsibility; therefore (assuming that they have had the first opportunity and have decided not to use it) it must ultimately fall to private enterprise to develop hydro-electricity. Municipalities, however keen to insist upon control of these matters, must realise that they cannot get such control unless they supply the necessary capital and take a proportionate share of the responsibility.

I now have to make a suggestion which is no new idea, either to myself or others, and has been occasionally more than hinted at in the technical Press, notably in the columns of the *Electrician* and ELECTRICAL REVIEW. In my opinion, and I believe many others are with me, the time has now come for an actual recognised co-operation of all branches of our industry, in its first stage to take the form of a National Electrical Convention to be held annually in a place chosen for its suitability, where each sectional association of the Convention will hold its own meetings, yet maintaining a close contact with the main body, and thus commence to reap the innumerable advantages which the consummation of such a scheme cannot fail to produce. I suggest that such a congress be held under the auspices of the Institution of Electrical Engineers as the proper body for the purpose. The Institution has here an excellent opportunity to put into practice many of the lines of organisation mentioned by Mr. Wordingham in his addresses during the time he was president of the Institution, and, what is more, has a great chance to show that it is prepared to amalgamate the Institution with the industry. Each Association in the whole industry should be represented at this convention. Immediately upon the formation of a new Council of the I.M.E.A. a few gentlemen should be appointed to approach the Council of the Institution and as many other Associations as is possible, with a view to bringing this desirable scheme to fruition.

There are many advantages about such a scheme. I may mention the moral effect that such a large and powerful Convention would have upon the public in general by keeping them in closer and more sympathetic touch with what is of much importance to them. Again, we would have the more general support of the lay Press, added to the loyal and well-tried assistance of the technical Press, to say nothing of the benefits which would accrue from the incidental propaganda and advertising value.

Although I believe that it would be preferable for the Institution of Electrical Engineers to take a lead in this formation of a national electrical convention, yet I realise the very heavy and constantly increasing work which falls upon that body, and it is just possible that it may not be practicable for this part of my suggestion to be carried out. In such an event, I suggest that the next institution, within whose scope such work logically comes, is the British Electrical Development Association, which has done sufficient valuable work under difficult conditions to show the necessary potentialities to indicate an assured success in such a direction. I think that an effort should be made first of all to get the Institution to move in the matter and show that it considers the commercial development of the industry as important as that of any other section.

In proposing a vote of thanks to the chairman for his address, Ald. WALKER reminded the meeting that they had also to thank him for the work that had already been carried out in anticipation of the meeting being held at Dundee. The vote was carried by acclamation, and the chairman responded briefly.

(*To be continued.*)

**Water-Power in the United States.**—The Federal Power Commission has received 222 applications for permits to utilise water-powers, aggregating 14½ million h.p. Twenty-nine permits have been granted respecting a total of about 2 million h.p., in 17 States; two of these are over 400,000 h.p. each, and three others average over 200,000.

## JOINT ELECTRICITY AUTHORITIES.

### London and Home Counties Inquiry.

(*Continued from page* 103.)

On Tuesday last week Mr. Tylor opened the case for the L.B. & S.C. Railway and the G.E. Railway.

Counsel said that under Section 11 of the Electricity (Supply) Act of 1919, the Companies had intended to bring forward schemes for dealing with their own supply, and to make the necessary application to the Commissioners, but they had not been able to get their schemes ready. The position now really was that the railway companies wished to be able to see in what way they could obtain supply most cheaply. If they erected their own stations with the consent of the Commissioners, then they would be willing to supply any surplus to the Joint Electricity Authority. Generally speaking, the railway companies had no objection to any of the present schemes, and all they asked was to be left in the position of being able to obtain their supply in the cheapest market. It was impossible for the railway companies to say, in the meantime, that they would take their supply from a public source. If it could be shown that the Railway Companies could get their supply most cheaply from a public source, then he felt he could say that the railway companies would take a supply in that way. The companies were not desirous of being involved in any capital expenditure which could be avoided, and it was mainly with a view to hearing what the promoters of these schemes had to say that the railway companies wished to be present at this inquiry. So far, the evidence for the promoters had all gone to show that the railway companies would be more likely to be able to generate a cheaper supply for themselves than by purchasing from a Joint Authority.

After lunch, Sir JOHN SNELL, speaking to the representatives of the railway companies, said the Commissioners felt it would assist them if they could have a railway witness.

Mr. MILLER said that, speaking after consideration, he had nothing to establish through a witness, but at any time he would be pleased to give the Commissioners any information. He was not in a position to assist the Commissioners now.

It had previously been arranged that such of the smaller opponents as cared could hand in statements instead of making speeches. Consequently, such statements were now handed in by representatives of Barnes, Kingston and Croydon.

The opposition of the Metropolitan Electric Supply Co. was then proceeded with.

Mr. A. W. TAIT, chairman of the company, was called, and explained the operations of the company as regarded the area inside the County of London, which is purchasable by the L.C.C. in 1931, and the bulk supply powers in Middlesex, which latter area it is desired to exclude from any of the schemes. At the present moment an additional 20,000 kW of plant is being installed at Willesden at a cost of £400,000. A recent bulk supply price quoted to Ealing was £4 10s. per kVA per annum plus 5d. per kWh, plus—in respect of coal—0.15d. for every 100 units when coal is over 20s. per ton. Any interference with the company by a Joint Electricity Authority would seriously hinder the company in raising capital. A large number of tables were handed in showing the financial position of the company.

Mr. J. S. HIGHFIELD, engineer to the Metropolitan Electric Supply Co., handed in further tables showing the position of the company so far as average prices, &c., were concerned. A three-phase, 50 cycle cable would be completed from Willesden to Uxbridge this year, and before long the whole of the supply would be on the three-phase, 50-cycle system, and the change-over from the two-phase, 60-cycle system would then be complete. Willesden still had room for another two 10,000-kW turbine sets in addition to the two similar sets now going in. This would fill up the site on the north side of the canal, but the company had nine acres on the south side of the canal where further extensions would take place. The Willesden stations of the Metropolitan Electric Supply Co. and the North Metropolitan Electric Power Co. were only a mile apart, and could easily be connected. Brimsdown was already linked up with the North Metropolitan Willesden station, and other stations in the area could be linked up very easily. The new plant going into the Metropolitan Co.'s Willesden station cost £20 per kW, and there would also be considerable economy of fuel consumption, the figure being about 2¼ lb. of coal per unit generated with normal coal.

A large number of questions were put by Sir John Snell as to how Mr. Highfield would proceed assuming the whole of the area under consideration were clear of any of the 77 stations now in it, but Mr. Highfield did not care to make the assumption, and preferred to deal with the position as it was to-day.

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On Wednesday, July 13, the opposition of the North Metropolitan Electric Power Supply Co. was taken.

Sir JAMES DEVONSHIRE, managing director of the Power Co., gave details of the incorporation of the company, the area of supply being about 326 sq. miles. The company now has authority to supply in bulk to authorised distributors and also for power purposes, these powers being held in perpetuity. Reference was made to the purchase of the Willesden power station of the Willesden Urban District Council, which, as a

matter of fact, is outside the company's limits of supply, but is held by the company in perpetuity. Moreover, the whole of the Borough of Stoke Newington, which is in the County of London, is now in the company's area of supply, whereas the remainder of the area is outside the County of London. An important feature of the company's powers was, said Sir James Devonshire, the authority to give or receive a supply from distributors in contiguous areas, and under those powers a supply had been given to Hackney. Thus there was nothing to prevent linking-up between the company and all authorities contiguous to its area.

An interesting question arose at this point as to whether it would be legal for the North Metropolitan Co. to supply an area contiguous to another area with which the power company was interconnected; for instance, to give a supply to Poplar through Hackney. The result of the discussion was that Sir James said there was no legal limit to the amount of energy which could be supplied to Hackney, and it was no business of his what Hackney did with it.

Continuing his evidence, Sir James enumerated the districts in which the power company was giving a supply for all purposes, Provisional Orders having been acquired. Dealing with other Acts obtained by the power company, reference was made to the fact that Parliamentary sanction had been given to the Metropolitan Railway Co. and the L. & N.W. Railway Co. to give a supply to the Power Co. from the Neasden and Stonebridge power stations respectively.

Sir JAMES DEVONSHIRE then went on to deal with the development of the electric tramway systems of Middlesex and Hertford, in conjunction with the Power Co. In addition to the authorised distributors taking a supply in bulk, the company had about 20,000 private consumers. The company had 168 miles of high-pressure mains and 156 of low-pressure mains. Statements were handed to the Commissioners showing the capital and revenue position of the company, units sold, &c. During the past two years the revenue had taken a leap upwards owing to the introduction of a coal clause in many of the power contracts.

Sir James said he objected to inclusion in the proposed London and Home Counties Electricity area. A Joint Electricity Authority would have a very vast business to deal with in the central area; he did not believe the Authority could help his company very materially, and his view in that connection was strengthened by what he had heard at the inquiry. At the same time, his company would always take or give a supply if it were more economical to do so. For instance, at the present time a supply was being taken from the Amberley Road station of the Metropolitan Electric Supply Co., and the Underground Electric Railway Company was also willing to give the Power Co. a supply. On the other hand, the Power Co. had given supply to outside authorities. The present supply of the Power Co. to authorised distributors was being given at prices lower than those shown in the estimates of the L.C.C. and the other schemes when everything which was contemplated had been accomplished. Indeed, he saw positive disadvantages from the proposals before the Commissioners. Even the promoters had suggested that they could not help the Power Co. for many years, and all they seemed to want was a contribution of about £5,000 or £2,500 a year towards the administrative expenses of the Joint Authority in the early years. He objected to paying anything for what was admittedly of no advantage. The company would have to pay a heavy contribution to the administrative expense because its sales were about 10 per cent. of the total in the area, and the administrative expenses had been put at £50,000 per annum. Another objection was that the Joint Electricity Authority could acquire power stations in the Power Co.'s area and supply them in bulk, thus competing with the Power Co. and depriving it of business, yet the *raison d'être* of the company's existence was to supply in bulk. He much preferred to remain under the Electricity Commissioners. He was a member of the B.O.T. Electric Power Supply Committee, and agreed to the recommendation to appoint Electricity Commissioners. Having got the Commissioners he wished to be left to enjoy what he had got.

Sir JOHN SNELL reminded Sir James that he also, as a member of that Committee, agreed to the appointment of District Boards.

Sir JAMES DEVONSHIRE replied that there was an exception made in the case of undertakings giving supply over a large area like the North Metropolitan Power Co. He believed the intention there was that the Joint Electricity Authorities should come up to the borders of the power companies and not go into them. He hoped that would be the case here. Finally, he agreed with Mr. Tait's view that the existence of the Joint Electricity Authority would interfere with the raising of capital.

Sir JOHN SNELL remarked that it did not seem to have affected the recent issue of the North Metropolitan Co.

Sir JAMES replied, amid laughter, that no mention was made in the prospectus of the black cloud which was hanging over the company.

Mr. CRAIG HENDERSON'S cross-examination was to the effect that the only real objection to inclusion on the part of the company was that it was likely to be called upon to pay a portion of the administrative expenses.

SIR JAMES DEVONSHIRE said he objected to inclusion because of the possibility of the Joint Authority filching away many small distributors from the Power Co., and, moreover, the Joint Electricity Authority was bound to have a political complexion which he objected to also. Moreover, the Act of 1919 did not compel the Commissioners to set up electricity areas. The Act said they " may " set up areas and he would object to inclusion in any area on principle. The Association of Power Companies had sent in a memorandum to the Commissioners urging that if Joint Electricity Authorities were to be financed out of public funds, the money raised on the security of the rates, then the operations of the Joint Electricity Authorities should be excluded from the areas of power companies. There might be strong political motives in the operations of such Authorities. Once the Joint Authority got into his area there would be a strong inducement to undercut him in prices for other reasons than purely commercial. Parliament incorporated this company to do much that it was proposed the Joint Electricity Authority should do, and he contended that there was no need for the Authority in his area.

Answering Mr. Turner, for the Conference scheme, Sir James Devonshire said he objected to public ownership in any form, and in these days he believed it was highly undesirable even that companies should be purchased by local authorities.

In the afternoon, Sir JAMES DEVONSHIRE continued his evidence. In reply to Mr. Lackie, who said that evidence which had been put before the Commissioners from time to time showed that there was a tendency for local authorities to supply electricity more cheaply than companies, Sir James said that he did not think much importance could be attached to that, because in the London area local authorities were often operating in industrial areas, whereas the companies supplied the West End and other residential districts.

Questioned by the chairman, Sir JAMES expressed the opinion that if the company had separate representation on the Authority it might be able to exercise some restraining influence over the political element. With regard to credit, local authorities were rather under a cloud as regarded finance. Local authorities going into the city for the purpose of raising money at the present time would be frowned upon, whilst a public utility concern in the hands of a company would be welcomed.

The CHAIRMAN then put a number of questions with regard to the coalition of the areas of supply of the North Metropolitan Co. and the Metropolitan Electric Supply Co. On this point Sir James said he did not think it necessary or desirable to amalgamate the two areas, but probably by the interchange of one or two directors on the boards of the companies concerned, all that was necessary could be achieved in connection with the efficient and economical supply of the two areas. He thought arrangements could be made between the two companies to prevent waste by endeavouring to supply consumers, say, on the boundary line of one company, by the organisation of the other, where they could be more efficiently and cheaply reached, and where this could be done they contemplated doing so. Therefore, if that flexibility existed between the two companies, no engineering and no financial improvement could be effected by the establishment of a Joint London Authority beyond that which was within the bounds of possibility to-day.

Mr. E. T. RUTHVEN MURRAY (engineer and general manager to the North Metropolitan Co.) handed in a number of tables dealing with the company's undertaking. With regard to power stations, there were eight within the company's area, of which four were the property of the company—namely, those at Brimsdown, Willesden, Hertford, and St. Albans. Of the remaining four, three were owned by the local authorities at Finchley, Hornsey, and Walthamstow, and one by the Tottenham Light, Heat & Power Co., at Wood Green. The total present capacity of the four stations owned by the company was 32,810 kW, and the capacity of the other four stations 10,250, making a total capacity over the whole area of 43,060 kW. The simultaneous maximum demand on the whole eight stations during 1920 amounted to 33,604 kW. Extensions of the various stations were now in hand, which, when completed, would increase the capacity of the company's four stations to 45,810 kW, and that of the remaining four stations to 16,550 kW, bringing the total capacity over the whole area up to 62,360 kW. In addition to the extensions already mentioned, the company's stations could be still further extended. The Brimsdown station alone was capable of extension to the extent of a further 50,000 kW or more, which would bring the capacity of that station up to 73,000 kW. A further 17,000 kW could still be installed at the company's Willesden station, bringing the total there to 36,650 kW. Extensions were also possible at the Metropolitan Electric Supply Co.'s stations at Willesden and Uxbridge, which would increase their total capacity to 92,100 kW, so that the combined capacity of the two companies' stations could be extended to 201,750 kW on existing sites, exclusive of plant in the stations of other undertakers. There were, therefore, ample facilities in the whole area to meet the demands likely to occur for many years to come, without going outside the system.

Dealing with reasons for the non-inclusion of the North Metropolitan Co.'s undertaking in any scheme for the establishment of a Joint Authority for London, Mr. Murray said that in the first place, such a scheme would involve the provision of long and expensive inter-connecting mains, which must affect the price of energy. The average price to be obtained for energy under the new scheme was 1.326d. per unit at the busbars of authorised undertakers. That was the average price for extra-high-pressure supply, but in view of

the factors which had to be taken into consideration, it was obvious that consumers distant from the central source would have to pay above the average, in order to cover transmission costs. If the North Metropolitan Co. had to pay up to 1.326d. per unit, which was just above its present figures, the average for 1920 being 1.284d., it could only supply at a loss. It was the policy of the company to purchase in bulk from outside sources when reasonable terms were obtained, and in 1920 it purchased 3,403,000 units. Estimating the future demand over the whole of the company's area, Mr. Murray said that the demand of 33,604 kW in 1920 would be increased to 37,250 kW in 1925, and to 42,000 kW in 1930, these figures leaving out of consideration railway supplies. In 1920 the total units sold by all producers in the area amounted to 75¼ millions, which would increase to 96 millions in 1930.

In reply to Mr. PAGE, witness said he did not think the case for capital stations was a very strong one, having regard to the cost at which energy could be produced at a small station having a high load factor.

As to voltage, Mr. MURRAY told Mr. Lackie that certain of the company's new mains would be worked at a pressure of 10,000 to 11,000 volts to commence with, but later on this would be increased to 22,000 volts.

The CHAIRMAN asked a number of questions as to the desirability of combining the areas of the North Metropolitan Co. and the Metropolitan Electric Supply Co., in reply to which Mr. Murray said he did not think, from an engineering point of view, there would be very much economy in working expenses, though there might be a saving in capital expenditure. As to the inclusion also of the County of London Co.'s area, which was suggested by the chairman, Mr. Murray expressed the opinion that better results would be obtained by keeping the County of London area distinct as one area, and the joint areas of the North Metropolitan and Metropolitan Electric Supply Companies as another, because of the expense which would have to be incurred in linking-up mains.

A lengthy discussion then took place between the chairman and Mr. Morse, representing the County of London Co., with regard to the Commissioners' request that the County of London Co. should give information as to the proposed Barking station, which was considered by the Commissioners in October last year. Mr. Morse said that technical details of the scheme had been dealt with at the previous inquiry, and the company, therefore, did not propose to call evidence on this occasion. The chairman pointed out that he wanted, among other things, information as to the anticipated growth of the demand in the County of London Co.'s area and the Romford area. Again, whilst the County Co. were of the opinion that the Barking station should be proceeded with at once, it was the contention of the promoters of the other schemes before the Commissioners that the erection of capital stations should be postponed, owing to the costs, and that the demand in the meantime should be met by utilising to the full the present resources. Seeing that a conflict of opinion existed, it was very material that the matter should be fought out, in order to arrive at the best course to pursue. The County Co. had had the opportunity of cross-examining witnesses giving evidence on behalf of the promoters' schemes, and of pointing out weaknesses in those schemes, and he suggested, therefore, that it would be fair if the County Co. put witnesses into the box to point out the advantages of the adoption of a totally different policy.

Mr. MORSE replied that the company had considered the matter carefully, and did not propose to give evidence at this inquiry.

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On Thursday, July 14th, Mr. ARTHUR COLLINS was recalled on behalf of the Conference scheme, especially with regard to the question of terms of purchase of the companies' undertakings. He said the resolutions passed by the Executive of the Conference and referred to in Tuesday's report, had been drafted as the result of observations made by himself on the subject. His opinion was that the question of acquisition of the stations of the companies should not be confused, at this stage, with the question of distribution. His main reason for this was that the Joint Electricity Authority would have plenty to do during the first ten years to handle the question of generation. Moreover, it was felt that if the L.C.C. acquired the undertakings of the companies in 1931, it would require the distribution to be carried out by the local authorities. Therefore, if the companies got the terms for their generating stations and mains suggested, with a guarantee of a supply of electricity during the next ten years at a price not greater than the present cost, the question of distribution in future could very well be left over for the present.

Sir JOHN SNELL reminded witness that the companies were willing to transfer their undertakings on the broad basis of cost less depreciation.

Mr. COLLINS agreed, and also mentioned that under the Tramways Act (Middlesbrough, Stockton and Thornaby Tramways arbitration) the terms had been cost of replacement less depreciation. He did not think that in 10 years the cost of plant would have got back to pre-war figures; in fact, Parliamentary estimates for water schemes were that in 10 years' time the cost of plant would be pre-war cost plus one-third or two-thirds. Assuming that in 10 years the cost of electrical plant would be 1¼ times pre-war, and the companies were willing to sell now for pre-war cost less depreciation, he admitted that the cost to the purchasers would be more than if the sale took place in 1931 under the terms of the 1888 Act, and so increase the cost of energy. At the same time, this was not entirely a question of the bare price of energy, because it was in the minds of many eminent engineers dealing with arbitration for the purchase of various public utility undertakings, to lay greater stress on the factor of obsolescence, and it would be argued that although the war had increased prices, at the same time obsolescence had proceeded at a greater rate and the increased rate of depreciation in consequence would largely offset the increase in price. Quite apart from this, he felt it would be very unwise to enter into a bargain with a vendor company at the present time when prices were falling very rapidly.

Sir JOHN SNELL: And would you leave matters in the present unsatisfactory state for 10 years?

Mr. COLLINS said he would not, and he hoped that the Conference would consult again with the companies and see how much nearer they could get together on the matter, but he did not think it would be wise to accept the companies' terms in return for a further life of 60 years as distributors.

Sir JOHN SNELL said that the local authorities had had a long time in which to consider this question of purchase, and it would be a pity if the inquiry had to close without a definite expression of opinion from the Conference on the point.

Mr. COLLINS said that at present the companies and local authorities were too far apart to agree, but he hoped that by further discussions a bridge might be found, perhaps on a smaller extension of term than 60 years, and a sliding scale of dividends and prices. He was, however, authorised to say that rather than pay the companies' terms the Conference would make an endeavour to co-ordinate the 34 local authorities and leave out the companies altogether.

Sir JOHN SNELL: And close this inquiry with an entirely inconclusive position as between the companies and local authorities?

Mr. COLLINS, further examined, said that another advantage to the companies under the proposed terms of purchase suggested by the Conference was that the companies would by selling now, have the money in hand 10 years earlier than otherwise, and at the same time they would have a guarantee of electricity from the Joint Authority. Moreover, he did not believe the companies in 1931 would have more than a sporting chance of getting more than pre-war cost, in consequence of the element of obsolescence to which he had already referred.

COUNSEL put it that the companies would only be brought to sell their generating stations and mains by agreement, and as the terms proposed by the local authorities were less than those which the companies would get under the 1888 Act, what earthly hope was there of getting them to agree? What had induced the Conference to change its view with regard to extension of tenure (the Chairman of the Conference said the Conference was willing to consider an extension of tenure)?

Mr. COLLINS said that since that statement was made by the Chairman of the Conference, they knew what the terms proposed were. He disagreed with counsel that the local authorities were hoping to get the companies' distributing systems after the L.C.C. had purchased the companies, and that that was the reason why the Conference objected now to an extension of tenure. At the same time, he felt that the local authorities were the right people to carry out the detail distribution in the companies' areas and not the L.C.C. In any case, the proposed terms by the companies were very much more serious than the Conference at one time thought.

Sir JOHN SNELL said it was very embarrassing to the Commissioners that the Conference had changed its mind so soon after a definite expression of opinion by Mr. Duncan Watson.

Mr. TURNER, for the Conference, said that Mr. Duncan Watson was expressing his own opinion.

Mr. CRAIG HENDERSON said that Mr. Duncan Watson had said the Conference would agree to the principle of extension of tenure.

Sir JOHN SNELL said that, speaking for himself, it seemed to him that the Conference was changing its mind from day to day, and how could the Commissioners come to a decision in these circumstances? Was it the intention of the Executive to recommend the full Conference to adopt the views put forward by Mr. Collins against the principle of extension of life of the companies as distributors?

Mr. TURNER said the matter was to be put to the full Conference without any recommendations.

Mr. COLLINS, answering Mr. Craig Henderson, said, personally, he would advise the Conference not to accept the principle of extension of tenure.

During Mr. Collins's evidence, there was an interposition by Mr. Albert Gay, chief electrical engineer to the Islington Borough Council. It appears that although Islington is a member of the Conference of Local Authorities, it has sent in certain objections independently.

Sir JOHN SNELL said it did not seem that the Islington Borough Council knew its own mind.

Mr. TURNER, for the Conference, said that in view of the position, he would take it that Islington was no longer a member of the Conference.

Sir JOHN SNELL suggested that Islington should send in a statement, a course with which Mr. Gay agreed.

Later on, a long discussion took place between Mr. Collins

and the Commissioners as to the terms of purchase of the companies; he put it frankly that the terms proposed by the companies were too great a price to pay for a unified electricity supply in London. He hoped, however, that the parties would come together again, although at present neither side would consider the terms put forward by the other.

Sir JOHN SNELL put it that there were 34 local authorities owning electricity undertakings, which were holding out with regard to terms of purchase by the L.C.C. for companies in areas in which the Conference of Local Authorities had no concern. Moreover, the L.C.C. as the purchasing authority was agreeable to the terms proposed by the companies.

Mr. COLLINS said that if the terms of the companies were accepted, it would mean either that the consumers in those areas would have to pay a much higher price for energy in the event of the distribution in the companies' areas being placed in the hands of the local authorities, or, if the L.C.C. retained the distribution in its own hands, which was inconceivable, then the extra cost would fall upon the whole of London through the L.C.C. rate. The point was, he said, that on the local authorities' valuation, the price which would have to be paid was considerably less than that which would be paid on the companies' basis, and the capital charges on that extra sum would have to be borne by some one.

Sir JOHN SNELL could not get Mr. Collins to agree with him that failure to come to terms with the companies would result in a continuation of the present state of affairs, because the 34 local authorities would go ahead by themselves, said Mr. Collins.

Sir JOHN SNELL replied that nothing effective could be done without the consent of the Commissioners, and it was placing the Commissioners in a very great difficulty if the various authorities did not agree.

Sir JOHN SNELL then asked how, in these circumstances, the Commissioners could refuse such applications as those of the County of London Co. and the West Kent Power Co.

Mr. COLLINS said it must be for the Commissioners to decide what was best for the area.

Sir JOHN SNELL concluded his questions by saying that time was passing; they were all looking forward to the revival of trade, and representations had been made to the Commissioners that there was a great need for improving the supply.

Mr. PEARMAN, secretary of the Westminster Electric Supply Co., then handed in further tables explanatory of the proposals of the nine companies with regard to purchase.

When the inquiry was adjourned for the day, Mr. SYDNEY MORSE, for the County of London Co., said his clients had reconsidered the question of giving evidence, and in view of the personal appeal of Sir John Snell, and in order to avoid any suggestion that the County Co. did not wish to assist the Commissioners, they had decided to put forward evidence on the matter of the relative advantages of erecting capital stations at once and extending existing stations.

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Sir Harry Haward presided over the inquiry on Friday, July 15th, in the absence of Sir John Snell.

Mr. JOHNSON (Comptroller of the London County Council) was then recalled, and handed in a number of tables giving revised financial particulars with regard to the results of the purchase terms proposed by the companies, applying them to companies and local authorities.

The case for the Hertford County Council was then dealt with.

Sir CHARLES LONGMORE, K.C.B. (clerk of the County Council) handed in tables containing statistics of the area and population of the county, which, he said, was largely agricultural and residential; the richer part of it was in the south, and was included in the delimited area. It would be an unfortunate thing if the richer portions were taken away, which would have a detrimental effect on the remainder. In some of the towns in Hertfordshire there was a good supply. That in Watford for instance was excellent. There were a number of Provisional Orders existing for the supply of electricity in various parts of the county, which had not been put into operation. Witness referred to the excellent relations existing between the county authorities and the North Metropolitan Power Co., which was supplying in parts of the county, and also with the Middlesex County Council in connection with the tramways which ran into Barnet from Middlesex, owned by the Metropolitan Electric Tramways. The Welwyn Garden City and the town of Hertford would be supplied from the Hertford generating station of the company, but it was contemplated that eventually mains would be laid from the Brimsdown station to Welwyn, and this would enable a supply to be given to Hoddesdon, Ware, and Cheshunt. Hatfield also needed a supply of electricity, and witness was of the opinion that it would be much more likely to get it from the company than from a Joint Authority embracing the whole of London. The company would more easily raise money than the local authorities to finance a scheme. On the whole, the opinion in Hertfordshire was that the supply of electricity would be very much better left in the hands of private enterprise. A conference of the County Council and of the local authorities in the county had decided that it was desirable to keep the whole county out of the scheme.

In cross-examination by Mr. Engelbach, for the L.C.C., Sir Charles said that even were the Joint Authority able to supply energy more cheaply in part of Hertfordshire than the North Metropolitan Co., he would still object to inclusion, in view of the administrative difficulties which would arise.

Mr. W. B. KEEN (accountant to the Hertfordshire County Council) also said it would be an advantage to leave the county as a whole out of the joint scheme. Being a residential area largely, a trifling reduction in the price of electricity would not affect the community so much as it would an industrial community, and they might buy such a trifling advantage at too great a cost from other points of view. The schemes before the Commissioners appeared to him to be very speculative, and depended on estimates at a time when it was almost impossible for anyone to make a reliable estimate. The Hertfordshire local authorities were not prepared to give financial support to the scheme, and, therefore, they could not expect any effective degree of control, without which it would be unsatisfactory that they should be subject to all its incidences. Lastly, it was a well-established principle that the local feeling of a community should not be overlooked, unless on the ground of very great public service. As to municipal credit, there had been so many issues recently on the security of the rates that the market was getting tired of them, and he was strongly of the view that Hertfordshire would be wrong to use its credit for the purpose of such an undertaking as that suggested.

Mr. HORACE FENTON (Electrical Power Engineers' Association) handed in a statement to the Commissioners, and stated that if it were desirable he would be able to bring evidence in the following week. The chairman said there was already a statement from the Electrical Trades Union, of which, however, Mr. Fenton disclaimed all knowledge.

A statement was also to be handed in by the town clerk of Watford.

Mr. PADDEN then addressed the Commissioners on behalf of the Port of London Authority, who asked for direct representation upon the administrative body of any scheme upon which the Commissioners might ultimately determine. The gist of the evidence during the inquiry had been that it was essential for the economical working of the capital stations that they should be constructed on the river. The erection of these stations would entail the construction of wharves, the dredging of the river, and many other things in order to adapt the riverside to the purposes of the engineers. A Joint Authority could not do that without the approval, cognisance, or licence of the Port of London Authority. Therefore, it was obviously an advantage that the latter body should have direct representation on the board of the Joint Electricity Authority. The point was whether they would bring enough technical advice and assistance to justify their representation, and he ventured emphatically to say that they would do so. Mr. Fladgate, in his evidence, said that the Port of London Authority might secure direct representation by virtue of their being large consumers of energy—and in this connection Mr. Padden mentioned that they purchased nearly 17 million units per annum—and he would raise no objection to their representation, subject to the consent of the Commissioners. Mr. Padden thought this was the general view.

Mr. WROTTESLEY, addressing the Commissioners on behalf of the Middlesex County Council, appealed for the taking-over of the whole of the Middlesex area, or leaving the whole of it out. Middlesex was the most developing area of all those around London to-day, and it was obvious that if justice was to be done to such an area, any scheme should take in, not as little, but as much of the area as possible. The engineering point of view was not the only one to be considered. The companies' scheme with a radius of ten miles round St. Paul's Cathedral, in which area was concentrated practically the whole of the load in the area delimited by the Commissioners, he described as skimming the cream off the milk. If the whole of Middlesex were left out of any scheme, the area would be sufficient to justify them in providing a supply of electricity for themselves, or in conjunction with some other authorities adjoining.

Their position was, in the first place, that they did not want to be split up. Secondly, with regard to the constitution of the Joint Authority, the suggestion of the L.C.C. was such that sufficient consideration was unlikely to be given to the interests of Middlesex. Thirdly, with regard to finance, they did not think the terms upon which the L.C.C. proposed to purchase generating stations and mains were as favourable and fair to the consumers and the local authorities as those of the Conference of Local Authorities. For these reasons, they asked to be left out of any area which was to be governed on the lines of the L.C.C. proposals. As to the scheme of the Conference of Local Authorities, subject to the Commissioners granting them representation—and they thought it not unreasonable to ask for two representatives—they were willing to be incorporated, provided the whole of the County were taken into the scheme.

The inquiry was then adjourned until Tuesday.

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Resuming the inquiry on Tuesday, Sir JOHN SNELL referred to a letter sent in by the Electrical Trades Union, and the statement by counsel for the Electrical Power Engineers' Association, and said that the Commissioners proposed to ask each of these bodies to put a witness in the chair.

Mr. C. H. MERZ was then called on behalf of the County of London Electric Supply Co., and said he appeared in response to the Commissioners' request that a witness should give evidence as to the relative advantages of constructing new power stations and extending existing stations. Mr. Merz's evidence occupied the whole of the day's session.

*(To be continued.)*

# NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

*Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.*

## A New Rotary Transformer.

We were recently given an opportunity to inspect a new type of rotary transformer patented by the Crypto Electrical Co., Ltd., Acton Lane, Willesden, N.W. 10, and saw a number of load tests carried out upon it.

The saving of space and expenditure effected by this means of transforming d.c. voltages as compared with the employment of the motor-generator method needs no emphasis.

The machines made by the Crypto Co. are designed either with "reverse-compound" or "level-compound" windings, the voltage regulation being carried out by means of interpoles. The reverse compound-wound transformer is eminently suitable for welding and kinematograph work, where the load is thrown on and off suddenly at frequent intervals. The level compound-wound machine is designed to maintain a constant voltage at all loads, and for this reason may be used for lighting supplies or other purposes in which violent voltage variation is undesirable.

The construction of these machines is safe and substantial. The armature is laminated, and the coils are former wound. The insulation between the primary and secondary windings is capable of withstanding more than 1,000 volts. The whole armature is vacuum impregnated, giving a high insulation resistance and dielectric strength. The frame is of cast iron, having steel poles with laminated tips; the field coils are former wound and impregnated. The bearings may be ball-bearings or of the ring type. In the case of the latter they are self-oiling, and made of the best anti-friction metal.

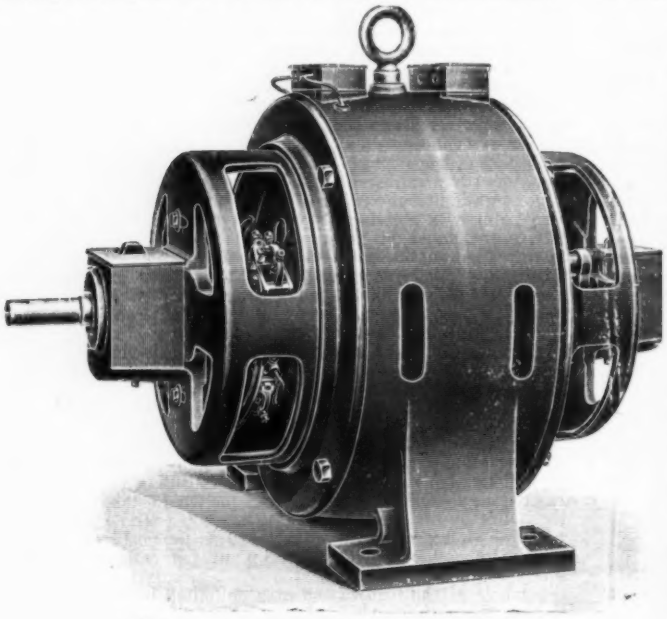

Fig. 1.—"Crypto" Rotary Transformer.

The machine seen under test was arranged for both level and reverse compound working. The supply to the primary end of the machine was at 460-480 volts; this remained practically constant at about 464 during the tests. In level compound working the secondary voltage at light load stood at 88.8; upon full load being applied it fell to about 88. At about 130 per cent. of full load the pressure fell a trifle more but the fluctuation was negligible for all practical purposes. In previous tests the variation between light load and full load (93 A) was only about .2 V, this was increased by about 2 V on an overload of 33 per cent. The speed varied from 1,480 r.p.m. at light load to 1,580 r.p.m. at full. The results when running as a reverse-compound machine were as follows: The voltage at light load was 86.5. Upon the imposition of a load taking 90 A the pressure fell to about 73.5 V. At 145 per cent. of full load the readings were 65 V, 130 A. The voltage at half-load was 79. During continued overloads there was practically no brush sparking, and the temperature rise was not excessive.

The illustration (fig. 1) shows a machine of the type described.

## A New Electric Seam Welding Machine.

The accompanying illustration (fig. 2) shows a new machine for seam welding the bodies of stamped kettles, designed and manufactured by the M.P. Electric Welding Machine Co., of 28, Hatton Garden, London, E.C. 1.

The machine operates on the "spot-seam" principle—that is to say, the rollers between which the metal passes during welding do not rotate continuously, but intermittently, making a series of overlapping spot welds in rapid succession. Each spot weld is made while the roller is stationary and extra pressure is applied to the roller before it moves forward, thus producing a much stronger weld than is obtainable by the normal pressure of the roller. An important advantage of the spot seam is that unpickled metal can be welded without difficulty, and there is far less tendency for any scale to attach to the rollers than when the latter are allowed to rotate over metal at the welding temperature. The rollers, therefore, require less attention and give better work. The welded seam is made at the rate of 3 ft. per minute, and 100 ft. of seam can be welded for an expenditure of 1 kWh of electrical energy.

The machine comprises a l.p. transformer arranged to suit the voltage and frequency of the available electricity supply, the secondary or welding circuit working at a pressure of only 2 volts; thus, there is no risk of any shock to the operator. The welding rollers or electrodes are connected to the secondary circuit, the upper one being mounted on a pivoted arm and driven by a ratchet mechanism, while the lower one is fitted on a slide and moved from side to side by a hand lever. When in the working position the slide is locked to prevent its displacement during welding; to make a weld the slide is released by a trigger on the hand lever and pulled to the right. The kettle, previously assembled, is placed over the lower electrode and the slide pulled back as far as it will go, where it is locked by a catch. The pedal is depressed by the operator, bringing down the upper roller on to the work and starting the weld. Nothing more is required of the operator beyond a slight guiding of the kettle to ensure the rollers passing properly over the seam. When the weld is made, the pedal is released, the slide pulled to the right, the kettle removed, and the operation repeated. The machine is suitable for welding the circumferential seams in various kinds of hollow articles varying in thickness from No. 25 gauge to 3/32 in. thick.

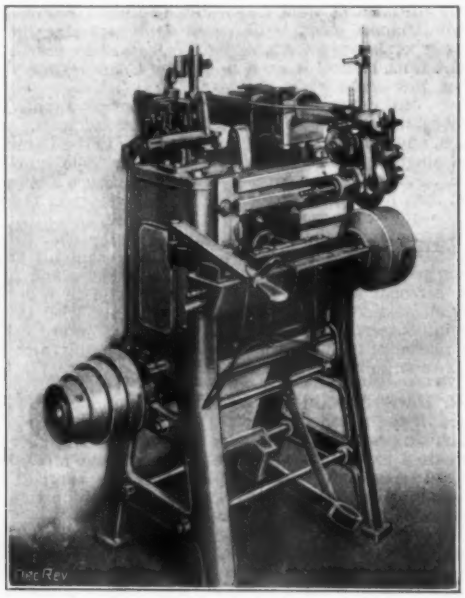

Fig. 2.—A new M.P. Seam Welder.

The M.P. Electric Welding Machine Co. makes a complete line of spot, seam, and butt welders, which are suitable for a wide variety of work.

**The Quadrant Electrometer.**—A new method of using the quadrant electrometer for the measurement of electrical power is described in the *Proceedings* of the Physical Society of London by Mr. H. Parry. It involves the use of a potential divider across the supply circuit, and a standard non-inductive resistance in series with the load. An ammeter and a voltmeter are employed to measure the supply voltage and the load current, and an example of the application of the method to determine the power factor of a condenser is quoted.

# BUSINESS NOTES.

**Bankruptcy Proceedings.**—George Edward Leigh Wynne, trading as the Amalgamated Trading Co., 44, Surbiton Road, Kingston-on-Thames, dealer in electrical goods, &c.—The adjourned public examination of this debtor was held recently at the Court House, Kingston, Surrey. The statement of affairs showed ranking liabilities £917, against assets £4, but debtor stated that the statement was incomplete, and his liabilities amounted to something like £1,600. Questioned by the assistant Official Receiver, he said that on his demobilisation from the Army in December, 1919, he commenced business as a boot repairer in Manchester, with £50. Subsequently he sold the business for £225, and in August, 1920, started as a manufacturer, importer and factor of electrical and aluminium goods, at 44, Surbiton Road, Kingston, the rental of the premises being £36 a year. At the time his capital was only £10, he was unable to pay cash, and obtained goods on credit. At the date of the receiving order, there were six judgments against him for £420. The examination was closed.

Reginald Percival Baker, electrical engineer, and Frederick Clarence Stubbs, electrical engineer, trading together in co-partnership as the Sheffield Electric Construction Co., 124, Pond Street, Sheffield.—The public examination of these debtors was held recently at the County Court Hall, Sheffield. The unsecured liabilities were returned at £522, while the assets were estimated to realise £316. Debtors stated that they commenced business with a capital of £10 each. They were successful until the slump. Machinery to the value of about £200 had been purchased, while the profits had been put into the business. The examination was closed.

John Hepher, trading as the Croft Electric Cabinet and Joinery Works, Dunn's Terrace, Spital Tongues, late 7, Croft Street, Newcastle-upon-Tyne, wholesale cabinet maker.—The adjourned first meeting of creditors was held recently at the Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne. The statement of affairs disclosed a deficiency of £1,527. Debtor attributed his position to bad trade owing to miners' strikes, depreciation in value of stock, heavy cost of removal of stock and machinery to present premises, and loss on a contract for the purchase of property. It appeared that he started business in Leazes Park Road, in March, 1908, with about £3 capital. In June, 1920, he removed to Dunn's Terrace, and he stated that the cost of this removal amounted to £400. Proper books of account had not been kept prior to June last. The creditors appointed Mr. J. A. Gardner, chartered accountant, of Grey Street, Newcastle, as trustee of the estate, assisted by a committee of inspection.

Toms, J. H., electrical engineer, 13, Gray's Inn Road, London.—Trustee, H. J. de C. Moore, 2, Gresham Buildings, E.C. 2.

Thomas, B. E., electrical engineer, 12, Castle Meadow, Norwich.—Last day for receipt of proofs for dividend, July 30th. Trustee, H. P. Gould, 8, Upper King Street, Norwich.

Pease, W. H., electrical engineer, York and Doncaster.—Supplementary dividend of 19s. 6½d. in the £, payable at Official Receiver's Office, 14, Fig Tree Lane, Sheffield.

Dale, B. T., electrical engineer, Erick Street, Newcastle-upon-Tyne.—Petition filed June 18th; order made July 7th.

Gee, G. H., electrician, 10, Front Street, Annfield Plain, Durham.—Petition filed June 7th; order made July 12th.

Carpenter, C. A., electrical engineer, 4 to 5, Masons Avenue, Basinghall Street, London, E.C.—Petition filed June 10th; order made July 11th.

Taylor, J. H., electrical engineer, 99, Blackhorse Street, Bolton.—Receiving order made July 15th on debtor's petition.

**Company Liquidations.**—W. G. C. Hayward & Co., Ltd.—A petition for the winding-up of this company has been presented by the Victoria Tube Co., Ltd., of Tipton, and will be heard on July 26th.

Electrical Maintenance Co. (Liverpool), Ltd., 8, Victoria Street, Liverpool.—Winding-up, with Mr. J. Airey as liquidator. Meeting of creditors, July 21st. Claims must be sent in to Mr. Airey without delay.

Little Wonder Battery Co., Ltd.—Creditors must send particulars of debts, &c., to the liquidator, Mr. R. G. Pye, 26, Budge Row, E.C., by August 19th.

Signal Electric Co., Ltd.—Meeting called for August 28th, to hear an account of the winding-up from the liquidator, Mr. E. H. Hawkins.

Stols Electrophone Co. (1914), Ltd., London.—Meetings of creditors and contributories, July 26th, at Carey Street, W.C.

Surrey Electrical Co., Ltd.—Meeting at Gresham House, E.C., on August 22nd, to hear an account of the winding-up from the liquidator, Mr. E. W. E. Blandford.

**Dissolution of Partnership.**—A. O. Walker & Co., electrical and mechanical engineers, 13, Queen Street, Liverpool.—Messrs. A. H. O. Walker and T. Storey have dissolved partnership. Mr. Walker will attend to debts and continue the business.

**Trade Announcements.**—Among the new Scottish companies registered last week was—Ross & Co. (Electric), Ltd., 62, Robertson Street, Glasgow. Capital, £20,000 in £1 shares. Private company, to acquire and carry on the business of manufacturers and agents for electrical accessories and supplies. Subscribers:—J. Smith, A. Thomson, jun., and Ernest F. Smith, electrical engineers, 62, Robertson Street, Glasgow.

Messrs. Scholey & Co., Ltd., Victory Works, Croydon, have recently appointed Messrs. Alston Scott & Co., of 50, Wellington Street, Glasgow, their representatives for the whole of Scotland. Stocks of "Croydon Premier" electric suction cleaners, "Kutmore" electric drills, small fractional h.p. motors, &c., will be held at the Glasgow address.

Messrs. Williams & Pell, of 5, Chancery Lane, W.C., ask that all future communications should be sent to them at their new address as follows:—Williams, Pell & Baring, 4, Regent Square, W.C. 1.

The Turbine Furnace Co., Ltd., have recently removed from their general offices at 5, Budge Row, to larger offices at 238b, Gray's Inn Road, W.C. 1.

Mr. J. D. McKenzie is starting in business as an electric light and power contractor, at 37, Dundas Street, Edinburgh, and desires to receive catalogues.

Messrs. Underwood (Manchester), Ltd., of 53, Brown Street, Manchester, have been appointed sole importers of Moonstone scientific illuminating glassware for the British Isles. New catalogues are in the printers' hands. Large stocks of all types are held in Manchester, the company having special stores at Pine Street for this purpose.

Messrs. B. Kewell & Co. have purchased the business of Mr. William Drysdale, electrical engineer, 24, Paxton Street, Barrow-in-Furness.

**Catalogues and Lists.**—International Film Traders, 5, Denmark Street, Charing Cross Road, W.C. 2.—An illustrated leaflet advertising portable electrical floor, table, and hanging fountains. Priced.

Pelican Electric, Ltd. (formerly Forrester & Fox, Ltd.), Beehive Wharf, Brentford, Middlesex.—An illustrated and priced catalogue of conduit fittings, grips, boxes, bends, &c.; several views of the works are given.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Catalogue Section "J," giving very full particulars of the "Simplex" colliery lighting system. Extracts from the rules governing the use of electricity in mines are given, and the compliance of the "Simplex" system with these rules is noted. The list gives prices and illustrations of joint-boxes, lanterns, cables, &c.

The Overseas Engineering Co., Ltd., 163-165, Great Portland Street, W. 1.—List No. 66, giving specifications and prices of "National" d.c. motors and dynamos; List No. 185, describing and illustrating "Overseas-National" small lighting sets and accessories; and List No. 83, dealing with the "Home" and "Camp" ice-making machines.

Messrs. George Ellison, Perry Barr, Birmingham.—A well-produced illustrated catalogue (76 pp.) giving details of circuit-breakers, a.c. starting-gear, and crane-control equipment.

The J. G. Brill Co., 150, Southampton Row, W.C. 1.—An illustrated magazine describing the application of various types of Brill cars and Birney safety cars to a number of railways and tramways.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4.—Price-list No. 10,957, illustrating and describing "All-Nite-Lite" transformers for providing energy from an ordinary lampholder to a small low-voltage lamp.

Messrs. Daniel Adamson & Co., Ltd., Dukinfield, Manchester.—A booklet describing the progress and productions of the firm in steam and pneumatic-power machinery.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—List No. 124, giving prices, illustrations, and descriptions of "Baby Paragon" ironclad switches and combined switches and fuses.

The Electrical Engineering and Equipment Co., Ltd., 109-111, Bank Buildings, New Oxford Street, W.C. 1.—Lists 58 and 59 giving full particulars and illustrations of d.c. and a.c. motors respectively; also List No. 70 dealing with d.c. generators.

Messrs. F. J. Shenton & Co., Ltd., 68 and 69, Shoe Lane, E.C. 4.—An illustrated and priced leaflet describing the "Supreme" fan regulator and "indestructible" electric bells.

**Catalogues Wanted.**—The Sloan Electrical Co., Ltd., of 8-12, Golden Lane, London, E.C., desires to receive catalogues from manufacturers of electric motors, starters, heating and cooking apparatus, wires and cables and accessories.

The Central Electric Construction Co., of Hallamshire Works, Rockingham Street, Sheffield, wishes to receive catalogues and prices of lamps, cable, motors, switchgear, and general accessories.

**Inquiries.**—A reader asks for information regarding the "Zanda" electric "horse." The makers of the "Brons" heavy-oil engine are asked for.

**For Sale.**—The following plant, &c., is advertised for sale in our advertisement pages to-day:—Electric drilling machines, 10-cwt. electric crane, 1-ton electric crane, generating sets, dynamos, motors, cable, lamps, accumulators, switchboards, &c., by Mr. Chas. D. Phillips (by order of the Disposal Board), at Swindon. Machinery, equipment and ship's fittings, including a large quantity of electrical equipment, by Messrs. Robson & Perrin, at Shoreham Shipyard. Two 1,000-kW British Westinghouse turbo-alternators with condensing plant and auxiliaries, by Rotherham Corporation. Fuse wire, wood blocks, "opal" bowls, telephones, motors, dynamos, &c., by the Assets Auctions Co., Ltd., London, S.E. 1.

**A Domestic Appliances Exhibition.**—The Westminster Electric Supply Corporation, Ltd., has again arranged an attractive exhibition of electrical appliances at the Eccleston Place showrooms. While the devices to be seen are generally of the usual types, there are one or two items worthy of particular mention. One of these is a small cooker recently designed by Messrs. Belling & Co., specially for installation in a workman's dwelling or other situation where space is precious. Cheapness has also been aimed at, and the result is an efficient cooker at a very low price. The construction is very simple; the body of the cooker is of unlagged sheet steel, and two 1,400-watt elements are fitted, with separate three-heat controls. The upper element is let into the top, so as to be exposed both to the inside of the oven, and to the atmosphere; in this way it serves a dual purpose as an oven-heater and a boiling ring. A more elaborate electric oven is that made by Messrs. Greens, of Englefield. This is a stoutly-built cooker with three-heat oven elements, two hot plates and a grill. Some special saucepans for employment with these cookers are on view. These are made in segmental shape, so that three may be fitted in together to stand on a hot-plate, thus using heat which, with circular saucepans would be wasted. A colour-matching lamp of American manufacture is shown. This has a large bronze-finished reflector, and the light is passed through special glass. The "Utility" light exhibited is a silvered glass reflector with numerous indentations used in conjunction with a 150-W gasfilled lamp, giving a powerful flood light. Fires of all descriptions, decorative and severely plain, are included in the show, and boiling rings, irons, fans and suction cleaners are well represented. A rather simple, but, it is stated, effective device for heating water in an ordinary kettle is displayed. This is a circular copper band which fits round the outside of a kettle. The band is heated by a nichrome strip connected to two plugs. Many lighting bowls of alabaster and glass are shown, as well as highly-coloured lamp standards and shades. The Corporation is doing a great deal to improve its domestic load, and the rates at which it hires out cookers, fires and irons are certainly a strong inducement to consumers to adopt them. The exhibition is not merely a spectacle—every appliance is demonstrated on request, so that intending customers may know what they are getting.

**New Japanese Company.**—The electrical engineering department of the Mitsubishi Shipbuilding Co., at Kobé, is to be made an independent joint-stock company capitalised at Y.15,000,000. It will take the name of the Mitsubishi Electrical Engineering Co., and a large new factory for its use is already in course of construction in the suburbs of Nagoya. This development draws attention to the enterprise being shown by Japan in electrical engineering. Japan already exports large quantities of electrical goods to China, besides supplying the home market. The quality of these products has been severely criticised, but the improvement noted in certain directions during the past 12 months is very apparent.—*Eastern Engineering.*

**The Italian Electrical Industry.**—Not the least remarkable feature of the electrical industrial position in Italy is the almost complete elimination of German interests, notwithstanding the fact that before the war the Teutons practically controlled the market. It is proposed that Italy shall produce almost the whole of her own requirements in electrical material, and there is a strong movement towards patronising home trade only. This has seriously upset the plans of the United States manufacturers who had prepared to take the market by storm after a diligently-organised publicity campaign and the dispatch of a small army of commercial travellers authorised to conclude contracts upon highly advantageous terms. The market, however, is still short of raw material, particularly large generators, transformers, and steel pipe for penstocks. Aluminium cell lightning arresters, which hitherto have not been manufactured in Italy, are also in request. Again, while large quantities of switchboards and auxiliary apparatus are made locally, there are certain special types of instruments, such as synchronising indicators and frequency indicators, that must still be imported. Other electrical supplies which are still in demand include incandescent lamps, telephones, self-starting single-phase motors, constant-current transformers, and carbon electrodes for electric furnaces.—*Reuter's Trade Service* (Milan).

**Catalogues Wanted for Riga.**—In connection with the catalogue and sample room recently established at the British Consulate at Riga, the British Vice-Consul (Mr. W. Skelton) reports that while a number of trade catalogues and samples have been received, the collection is not sufficiently comprehensive to meet local requirements, and he would therefore be glad to receive additions to it. Catalogues dealing with machinery and accessories for asbestos manufacture are particularly required. The Vice-Consul points out the advantage which will ultimately accrue from this method of advertising even though there is no immediate demand for the particular article dealt with. Copies in duplicate of catalogues or other trade literature (preferably in Russian or German) should be sent. As there is at present no parcel post in Riga, the Department of Overseas Trade in London is endeavouring to arrange for the collection and dispatch in bulk of catalogues and small samples.

**Mining Plant for Canada.**—The proprietors of one of the oldest mines in Canada are desirous of entering into communication with United Kingdom manufacturers of steel hardening furnaces, electric mine hoists for a depth of 2,000 ft., and other mining equipment and supplies, of which they are regular purchasers. The name and address can be obtained by United Kingdom manufacturers and exporters on application to the Department of Overseas Trade in London.

**Cost of Living, Wage Reductions, and Unemployment.**—The average level of retail prices of all the commodities taken into account in the statistics prepared by the Ministry of Labour (including food, rent, clothing, fuel, and light, and miscellaneous items) on July 1st was, states the *Labour Gazette* (the organ of the Department), 119 per cent. above that of July, 1914. This figure is the same as that for June, decreases in the prices of some articles having been counterbalanced by increases in the prices of others. Reductions in rates of wages reported as having come into operation in June, in the industries for which statistics are compiled by the Ministry of Labour, affected about 1,060,000 workpeople. The number affected by increases in rates of wages was only about 14,000. The net effect of all these changes was a reduction in weekly full-time wages amounting to nearly £420,000. Since the beginning of the year, changes in the rates of wages reported to the Department have resulted in a reduction of about £1,770,000 in the full-time weekly wages of over 4,800,000 workpeople, and an increase of £83,000 in the full-time weekly wages of 350,000 workpeople. Following on the drop of 9,172 in the number of unemployed on July 1st, as compared with June 24th, the weekly figures issued by the Ministry of Labour show a further fall of 50,000 for July 8th—evidence of the gradual resumption of industry following on the settlement of the coal dispute. The following totals indicate the number of wholly unemployed on the Live Registers of the Employment Exchanges throughout the United Kingdom on July 8th as compared with July 1st (the latter figures being in parentheses):—Men, 1,548,113 (1,557,010); women, 434,503 (466,965); boys, 77,109 (80,539); girls, 60,776 (65,883); total, 2,120,201 (2,170,397). On July 8th there were 182,985 persons registered as wholly unemployed among 23 Exchanges in the L.C.C. area. This number, which is 3,744 less than the previous week, was composed as follows:—Men, 126,523; boys, 7,278; women, 43,020; girls, 6,164.—*Morning Post.*

**To Finance Electrical Undertakings in Poland.**—The Electrobank is the name of a new company which has lately been formed in Warsaw with a capital of 150,000,000 Polish marks, to finance electricity supply undertakings throughout Poland.

**New Electrical Companies in India.**—Among the new companies recently formed in India in connection with the supply of electricity for lighting and power purposes, are the Western India Electric Co., 7-11, Elphinstone Circle, Calcutta, capital, 100,000 rupees; and the Central Province Electric Supply Co., Jubbulpore, capital, 2,500,000 rupees.

**Australian Tariff Board.**—The Federal House of Representatives has passed the Bill to constitute a Tariff Board, composed of three members, to which the Minister for Trade and Customs may refer matters relating to the classification and value of dutiable goods, the necessity of tariff and excise increases and reductions and the granting of bounties. An amendment proposed by the Labour Party was adopted empowering the Tariff Board to inquire into the refusal of manufacturers to sell goods of a value under £50.—*Reuter's Trade Service* (Melbourne).

**Canada and Overseas Trade.**—The Department of Trade and Commerce is extending its overseas service to the East with offices at Calcutta and Singapore.—*Reuter* (Ottawa).

**Electrical Goods in China.**—Figures just issued in relation to the trade of China show that there is a growing market for electrical materials. The demand for electric lighting in most cities in China where plants exist generally exceeds the supply, most of the plants being overloaded, which fact is leading to an increasing disposition among Chinese to put down small private plants. This trade is now largely in the hands of Americans. In many cities there are merchants sufficiently progressive to install small plants for the purpose of lighting their own and several adjacent premises. The latest Customs report says that "there is a tendency in the more important establishments to install larger units, and whilst a few years ago 200 and 400 kW were considered large, it is now quite common to install units of 1,000 kW and upwards, and it is reported that a large number of orders has been placed for privately-owned power stations for the purpose of supplying power to cotton and flour mills. Although, says *Finance and Commerce*, a fair amount of this business has materialised, it must not be thought that the Chinese are falling over each other to get plant. In many instances it takes a good deal of nursing, but the business is there to be done. The importation of electrical materials into China amounted to 2·3 million taels in 1913, 5 millions in 1919, and 6·3 millions in 1920.—*Reuter's Trade Service* (Shanghai).

**The Currency Position and Trade Depression.**—The Federation of British Industries, on July 12th, addressed a communication to the Prime Minister on the subject of currency deflation and trade depression. The policy of the Treasury and the Bank of England is at present based upon the report of the Cunliffe Commission, and aims at a gradual deflation of the currency, in order to get back as soon as possible to the pre-war gold standard. The Cunliffe report, however, was issued in 1918, when prices had already risen far above the pre-war level. Since then conditions have changed considerably, and the trade boom has given place to serious trade depression. Under these changed conditions, the Federation points out that the policy of currency deflation is calculated to prolong the trade depression, and recommends the Prime Minister to appoint a Committee on the lines of that presided over by the late Lord Cunliffe, to examine the currency position in the light of present facts.

**Belgian Commercial Mission to Latin-America.**—H.M. Legation at Brussels states that the keen interest which is being shown in Belgium in the development of trade with South America is again made manifest in the proposal to send a commercial mission to South and Central America countries. The countries to be visited are Brazil, Uruguay, Argentina, Chile, Bolivia, Peru, Ecuador, the Central American Republics, Mexico, Cuba, Haiti, San Domingo, Colombia, and Venezuela. The members of the mission will consist of delegates of each section of the "Comité Central Industriel," and leading banks have also been requested to designate delegates with a view to the organisation of credit in South America. On the arrival of the mission, lectures will be given in the Spanish and Portuguese languages with a view to making known the power of production of the Belgian nation. Catalogues of Belgian manufacturers will be compiled in Spanish and Portuguese, and it is intended to hold an exhibition of these catalogues, and also, if possible, of samples, in every town visited. In addition, a special pamphlet is being prepared by the "Comité Central Industriel" with a view to broadcast distribution. The Mission will not only be concerned with Belgian trade propaganda, but will also carefully study markets in the countries visited. It will inform itself of the desiderata of possible customers, and take note of their preferences and local customs in order that Belgian goods may conform to the classes of articles usually preferred.—*Board of Trade Journal.*

**The Electrical Contracting Industry.**—The report of the three Associations connected with the electrical contracting industry, for the year 1920-21, shows that the membership was once again augmented. The membership totals on May 1st were as follows:—E.C.A.I., 668; N.E.C.T.A., Ltd., 573; N.F.E.A., 694. A number of resignations are recorded, these being attributed to (1) members ceasing to carry on business; (2) members objecting to the N.E.C.T.A. Trading Agreements; and (3) members opposing the institution of the Subsidy Fund. For the first time in their history the income of the Associations has exceeded their expenditure. N.E.C.T.A. reports a surplus of £1,957, of which £594 is carried forward after payment of a dividend and contributions to reserve fund and staff provident fund. The E.C.A. hopes to secure the registration of contractors at an early date. The same Association is also endeavouring to arrange a line of demarcation between its activities and those of the I.M.E.A., to remove several grievances arising from municipal trading. Negotiations with the E.L.M.A. have resulted in the new grading terms for lamps, which would have adversely affected the contractor, being withdrawn. The C.M.A. agreements have been renewed, resulting in an income of £25,000 to members over and above the ordinary trade discounts. The official journal, *The Electrical Contractor*, has again had a successful year. The report reviews the wages settlements which have been effected during the year and later, and states that a great part of the work of the N.J.I.C. for the industry seems to have fallen upon conferences of the N.F.E.A. and the E.T.U.

**Industrial Waste.**—At a Conference of employers and Trade Union officials organised by the Industrial League and Council (Birmingham Branch) and held during the week-end at Diocesan House, Coleshill Park, Birmingham, Mr. Robert Stelling read a paper on "Industrial Waste of the Past and Present." He dealt with the question from the point of view of the responsibility of managers, foremen, and workmen in relation to waste of time and materials in the management of factories and in the workshops. Altogether three sessions were devoted to the consideration of the subject on the Saturday and Sunday, and the debate, which was participated in by all present, was very exhaustive.

**New German Engineering Combine.**—*The Times* correspondent in Berlin gives particulars of an important new fusion of interests in the West German industrial world which is to take place shortly. At a board meeting of the Rhenish Metal Goods and Machine Works, at Düsseldorf, the reorganisation of the undertaking was decided upon with a view to securing the construction of locomotives and trucks and developing the firm's other branches on a permanent basis. It is intended to link up with Krupp's, the Allgemeine Elektricitäts Gesellschaft, Lincke-Hoffmann, and other concerns, and to extend activities to include several new branches of electrical construction. The Cologne firm of Wolff is to be included in the new combine on account of its favourable connections abroad. The capital of the Düsseldorf Machine Works will be raised by 75,000,000 marks (about £300,000). The prosperity of the undertaking was emphasised by the chairman of the board, who stated that a great deal of progress had been made in locomotive building, and that the prospects in kindred branches of industry were very favourable.

The Berlin correspondent of the *Daily Chronicle* referring to the same matter, says:—"In essentials this gigantic scheme has a still wider purpose. It represents another stage in the great project German industrials have in preparation for what they are convinced is the quickly approaching age of electricity in transport. The A.E.G., of which Herr Rathenau, the recently appointed Minister of Reconstruction, is the head, is a trust second only to that of Hugo Stinnes, and is world famous for its electrical machines and articles. Already it had acquired the largest existing locomotive building and repairing shops in Germany, the Linke-Hoffmann works in Breslau, turning out 300 locomotives and 80,000 railway wagons yearly. It specialises in electric locomotives."

**The Christiania Fair.**—The second Norwegian Industries Fair, which is to be held in Christiania in September, will include (*inter alia*) the following groups:—Machines and implements; electricity and gas, metal manufactures and tools, instruments; iron and steel, and glass, porcelain, and similar products.

**"Germany Ready to Undersell the World."**—"Germany to-day is in a position to undersell the world on most manufactured articles," said Charles G. Du Bois, president of the Western Electric Co., on his return to America from six weeks of intensive data gathering in France, Switzerland, Austria, Hungary, Germany, Belgium, and England.

"Industrially Germany seems to be as efficient as ever. With wages low, as measured in the currency of other countries, with highly competent workers eager to produce, and with the reparation question in a more settled state, Germany is in a position to go ahead in building up her industries to handle export business. At present she can turn out many lines of manufactured articles to sell profitably for less money than any other country.

"As nearly as I can calculate it, the cost of German labour in the metal working trades is about one-sixth of the cost of equivalent labour here. While in all probability this will lead to protective measures on the part of competing countries, such as taxes on German exports and other measures for the encouragement of home industries, yet wages in such countries are now decreasing, and this tendency is likely to continue if they effectively meet German competition in foreign trade.

"Looking at the other side of the picture, however, we see not exactly unrest, but a grave question arising as to whether the working population can, or will, continue to accept its present low standard of living. The danger in Germany, therefore, is of a social overturn more than anything else. Politically, the various Socialist parties seem to be in the majority, but the anti-Socialists are in control of the Government, largely because the Socialists do not care to assume control at a time when they cannot hope to make good all their promises. . . . .

"Looking below the surface, the immediate situation in England is serious," Mr. Du Bois continued. "Hundreds of thousands of people are out of employment. Rail transportation is seriously impaired. The Labour Unions as well as the employers are agreed that there must be lower wages, but the bone of contention is the amount by which wages must be reduced. In due course the British always appreciate the logic of circumstances, and it seems certain that an agreement will soon be reached. England in the meantime is losing heavily in trade balance.

"There is one thing, however, common to all European countries: The people everywhere are thinking and talking about earning a living. This is a change from my visit in 1919, when world movements, world politics, and world improvement seemed to engross their thoughts. Now there is a much clearer realisation of the long-continued hard work necessary before normal conditions can be restored."—*Electrical World.*

**Petition Dismissed.**—A petition for the winding-up of the E.B.C. ELECTRICAL CO., LTD., of Eagle Street, London, presented by Mr. L. C. Harvey, a consulting engineer of Westminster, a shareholder, was dismissed by Mr. Justice P. O. Lawrence, on Tuesday. His Lordship held that the petitioner, not having paid up the calls on his shares, was not entitled to succeed. The company was formed for the manufacture of electric lighting sets, and electric starters for motor-cars.

**Copper and Lead Prices.**—MESSRS. F. SMITH & CO., reported on July 19th:—Copper (electrolytic) bars, £75 10s., 40s. decrease; ditto sheets, no change; ditto wire rods, £91 10s., 40s. decrease; ditto h.c. wire, 11¼d., ¼d. decrease; silicium bronze wire, 1s. 3¼d., ¼d. decrease.

MESSRS. JAMES & SHAKESPEARE reported on July 20th:—Copper bars (best selected), sheet and rod, £105, £7 decrease; English pig lead, £24 15s., 5s. increase.

**The Dover Dispute.**—The dispute between the Dover Corporation and members of the staff of the electricity works seemed likely to result in a withdrawal on the part of the staff on Tuesday last. We learn from the secretary of the E.P.E.A., however, that as the outcome of negotiations, the Electricity Committee decided to recommend the continuance of the salaries payable under the "E.P.E.A. Award," with certain adjustments, and a stoppage was averted. The Corporation has since accepted the recommendations of the Committee.

**Standardisation of Contract Forms.**—Great interest has been evinced in the Federation's decision to undertake an inquiry into the conditions of Government and municipal contracts and tenders, with a view to the elimination of existing difficulties, and, if possible, to standardisation of type. A large volume of evidence and of proposals on various points has been received from different quarters, which will require detailed consideration. It was accordingly decided at the last meeting of the full committee that a small sub-committee should be formed to investigate the fundamental clauses essential to all contracts, and to report to the main committee. The following gentlemen were asked to serve:—Mr. Thomas Biggart (chairman); Mr. D. A. Bremner, B.E.A.; Mr. D. N. Dunlop, B.E.A.M.A.; Mr. M. Mannaberg, National Federation of Iron and Steel Manufacturers. In view of the wide scope of the committee's work, it was also agreed at the meeting to alter its name to the "Government and Public Bodies' Contracts Committee." The detailed investigation and comparison of various forms of contract and tender involved in the inquiry will necessitate some time before constructive proposals can be evolved,—*Bulletin of the F.B.I.*

**The British Empire Exhibition.**—At a recent meeting of the executive committee of the British Empire Exhibition, it was stated that there had been a delay in the acquisition of Wembley Park. In order to retain the Park for the Exhibition, however, Mr. Hiam, of Cambridge, had agreed to purchase it and hold it at the committee's disposal. It was suggested that a meeting should be held for the purpose of obtaining guarantees; this was referred to the administrative committee.

**South Africa.**—TRADE AND INDUSTRIES.—Mr. Malan, Acting Prime Minister, has appointed a Board of Trade and Industries with a strong personnel, which includes Sir Edmond Gorges, to hear and examine complaints and recommendations made as to the working of the Customs and Excise tariffs, and to advise the Government as regards (1) the recasting of the Customs tariffs and the adjustment of anomalies; (2) such action as may be necessary or advisable for assisting and developing the industries of the Union; and (3) such other matters as the Government may refer to the board.—*Reuter's Trade Service* (Cape Town).

**Holidays.** — The works of the MIDLAND ELECTRIC POWER INSTALLATION CO., at Wolverhampton, will be closed from the evening of Friday, July 29th, until the morning of Monday, August 8th.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—Works and offices entirely closed from Wednesday, July 27th, to Tuesday, August 9th.

**Inter-Allied Colonial Exhibition.**—The Paris Municipal Council has been discussing various plans for the organisation of an important inter-Allied Colonial exhibition, to be held in the French capital in 1925. A plan for the establishment of the exhibition in the Bois de Boulogne was rejected, as was also a plan for the holding of the exhibition in Paris itself, on the ground that nowhere could sufficient space be found. Finally, it was decided that a great part of the exhibition, including all the cumbrous exhibits, should be held in the Bois de Vincennes. It is estimated that the cost of the exhibition to the city of Paris will amount to about 50 million francs.—*Reuter's Trade Service* (Paris).

**The Spanish Customs Tariff.**—The *Gaceta de Madrid* publishes a project for a new definitive Customs tariff prepared by the Permanent Commission of the Junta de Aranceles y Valoraciones. The Government announces that claims and petitions in connection therewith will be received during a period of two months, at the end of which they will be considered by the Junta, and a definitive tariff prepared as soon as possible. The proposed tariff represents a profound modification in the organisation of Spanish commercial relations with foreign countries, owing to the introduction of a first and second tariff in the import section, the increase in the import duties, and the changes in the export duties on lead, iron, and copper ore, for instance. It is expected that many protests will be raised against the changes in the duties, but not many of these protests appear likely to meet with success unless serious concessions are made by the other contracting parties.—*Reuter's Trade Service* (Madrid).

**Manufacturing Works in Austrian Succession States.**—The General Deposit Bank of Vienna has issued a memoir in connection with the celebration of the fiftieth year of its existence, showing the economic efficiency of the States resulting from the partition of Austria-Hungary. In the case of electrical manufacturing, the memoir indicates that the works remaining in Austria employed 20,000 workpeople in 1913, and produced manufactures of the then value of £10,410,000; the works now comprised in Czecho-Slovakia had 5,000 workers, and turned out electrical goods worth £2,080,000; and the figures for Hungary were 3,000 and £1,040,000 respectively.

**Electrical Equipment in New Zealand.**—The Public Works Department will shortly be calling for electrical equipment to the value of £250,000. The material for which tenders will be invited includes generators, transformers, and insulators.—*Reuter's Trade Service* (Wellington).

**German Metal Workers' Union.**—The membership at the end of last year of this Union, the largest trade union in Germany, was 1,608,932, says the *Daily Intelligence* of the International Labour Office. Its turnover was 140,000,000 marks; 16,000,000 marks was spent on unemployment relief during the year, and 11,500,000 on health insurance.—*Financial Times.*

**Developments on the Congo.**—*The Times'* Brussels correspondent states that the Belgian Minister of the Colonies has outlined an extensive programme of public works, which Belgium proposes to carry out in the Congo, and which are expected to cost £120,000,000, in the next five years.

**The Postal Congress at Stockholm, 1924.**—*The Times* states that delegates from various countries are meeting in August at Zermatt to prepare for the Postal Congress at Stockholm in 1924.

**Book Notices.**—"Science Abstracts." Vol. 24. Part 6. Sections A, Physics, and B, Electrical Engineering. London: The Institution of Electrical Engineers. Price 2s. 6d. per part.

"The Theory of the Induction Coil." By E. Taylor-Jones, D.Sc., F.Inst.P. (217 pp. 93 figs.) London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d. net.

## LIGHTING AND POWER NOTES.

**Argentina.**—ROSARIO.—A new 11,000-kW Escher-Wyss turbo-alternator is being installed at the Sorrento power-station of the Société d'Electricité de Rosario.

**Australia.**—SYDNEY.—At a recent meeting of the City Council, the Lord Mayor stated that the accounts of the electricity undertaking for the past year's working would show a loss. He pointed out, however, that, although prices of other commodities had increased by from 50 to 150 per cent., as compared with pre-war prices, electricity charges had remained the same. In fact, in several instances they were actually lower.

**Barnes.**—YEAR'S WORKING.—The results of working of the electricity undertaking during the year ended March 31st last were as follows (the figures for the preceding year are given in parentheses):—Revenue, £37,672 (£25,356); working expenses, £27,038 (£17,910); gross profit, £10,634 (£7,446); net profit, £2,798 (£1,627); units sold, 2,771,643 (2,063,221).

**Birmingham.**—ELECTRICITY DISTRICT SCHEME.—At its meeting, last week, the Birmingham City Council had under consideration the scheme for the supply of electricity to the South-West Midlands District under the Electricity (Supply) Act, 1919. In view of the fact that approximately 98 per cent. of the supply in the district is generated by the Birmingham Corporation and the Shropshire, Worcestershire, and Staffordshire Electric Power Co., and of the fact that both give an identical supply of three-phase, 25-period, alternating-current at a pressure of 5,500 volts, the Electric Supply Committee considered that the requirements of the district could best be served by retaining the organisations of the Corporation electricity supply undertaking and of the Electric Power Co.'s undertaking as separate entities, rather than by the formation of a joint electricity authority for the district; the Electric Power Co. agreed, and a joint scheme on these lines has been prepared. It is proposed that the district as provisionally determined by the Electricity Commissioners shall be modified by the omission of the rural district of Atherstone and a portion of the rural district of Tamworth. The Birmingham Corporation is to be responsible for the electrical development of the City of Birmingham and of that portion of the district situated in the County of Warwickshire. The Power Co. is to be responsible for the development of the remainder of the district situated in the Counties of Shropshire, Worcestershire, and Staffordshire. The two undertakings are to be ultimately linked together and save as may be agreed from time to time between the parties concerned, the Birmingham Corporation and the Power Co., respectively, are to exercise control of the generating stations and main transmission lines belonging to them in their respective portions of the district; are to be responsible for the capital expenditure incurred by them, respectively, in the areas for which they are responsible; and the financial arrangements regarding capital and revenue accounts are to continue on a separate basis as heretofore.

A Committee, to be described as the South-West Midlands District Electricity Committee, is to be established (consisting of four members, two of whom will represent the Birmingham Corporation and two the Power Co.), with advisory functions only upon such matters as the operating time-tables of the undertakings; the best load factor obtainable; conservation of fuel; proper return upon the capital moneys expended and to be expended; the standardisation of systems; regularising the supply, and generally to carry out the directions of the Electricity Commissioners.

NEW PLANT.—The Council sanctioned, in June, 1920, an additional 30,000 kW of plant, with buildings, at the Nechells permanent station, with underground mains and other works, involving an expenditure of £1,757,800, subject to the Finance Committee's being able to raise the necessary money. The Finance Committee reported at the same meeting that it had no funds in hand or in sight for this purpose. The Committee, therefore, in February last, recommended proceeding immediately with:—(1) The installation of a 5,000-kW generating set, with boilers, at a cost of £120,000; (2) the piling of the site in anticipation of the larger extension, at a cost of £20,000; and (3) certain mains extensions at a cost of £30,000, in order to enable it to carry on the supply for a period of 12 months, and so postpone the necessity for proceeding with the larger extension. The City Council sanctioned this proposal, subject to the Finance Committee being able to raise the necesary money. The Committee is now informed by the Finance Committee that the Council would not be taking an undue risk if the Electric Supply Committee were authorised to provide a 15,000-kW generating set with three boilers, which will be part of the original scheme sanctioned in June, 1920, and for which it will only be necessary to raise the money in instalments between 1922 and 1925.—*Birmingham Post*

**Bradford.**—YEAR'S WORKING.—The accounts of the Corporation Electricity Department for the past financial year show an income of £435,692; working expenses, £331,972; leaving a gross profit of £103,720. Revenue charges absorbed £93,117, leaving a net profit of £10,603. The number of units sold was 55,700,000, an increase of 6,400,000.

**Bury.**—YEAR'S WORKING.—The total revenue of the Corporation electricity department for the year ended March 31st last was £98,406, as compared with £77,430 in the preceding year. Working expenses amounted to £77,873, as against £58,364, leaving a gross profit of £20,533 (£19,066). The net profit, after deduction of capital charges, &c., was £2,419, almost the same as last year's

profit of £2,377. The number of units sold rose from 15,367,885 to 16,931,907, the maximum simultaneous demand being 6,095 kW. The bulk of the capital expenditure (£37,000) was in connection with the Chamber Hall Works and plant.

**Chichester.**—PURCHASE OF UNDERTAKING.—The City Council has arranged to take over the undertaking of the Chichester E.L. & P. Co. at a price of £16,500.

**Chipping Norton.**—PROPOSED PRICE INCREASE.—The Electric Supply Co. has given notice to the Town Council of its intention to apply for an order to increase the maximum prices for electricity. The Council has decided to object, as it is considered that the present time is one for decreases rather than increases in prices.

**Continental.**—SPAIN.—The Department of Overseas Trade is informed by the British Vice-Consul at Granada that a company has been formed at Granada under the name of "Sociedad Anonima Fuerzas Motrices del Valle de Lecrin," with a capital of five million pesetas, with the objectlof erecting and working hydro-electric power stations in the Valle de Lecrin. It is proposed to erect the first station on the River Durcal, where a fall of 758 metres will be utilised and 4,000 h.p. produced.

SWEDEN.—Seventy-eight associations have applied for loans amounting in all to over kr.12,000,000 for the purpose of carrying out local electrification schemes.—*Reuter's Trade Service* (Stockholm).

**Conway.**—BULK SUPPLY.—The North Wales Power Co. has submitted draft proposals to the Conway Corporation for the laying of transmission trunk lines for the supply of electricity in bulk to the Corporation, which now has the agreement under consideration.

**Darlington.**—COAL DISPUTE LOSS.—Alderman Sir Charles Starmer stated, at a meeting of the Corporation, that there had been about £4,000 additional cost at the electricity works as a result of the coal dispute, but, with a reduction of 6s. per week in the men's wages and various economies, together with increased consumption, the Committee hoped to make up this amount without increasing the charges either for power or lighting purposes.

**Dominican Republic.**—NEW HYDROELECTRIC PLANT.—*The Times Engineering Supplement* states that a new hydro-electric works is to be built on the Jiminos River, in the Republic of Dominica. The locality chosen is in the mountainous interior of the Province of La Vega, about 25 miles south-east of the nearest railway station. Owing to the difficulties of transport only a 1,000-h.p. plant will be installed at first, the intention being to contruct a light electric tramway from La Vega before installing the larger plant, which will then supply light and power to La Vega, Salcedo, San Francisco-de-Macoris, Moca, and other small places in Cibao, as well as to Santiago and Puerto Plata, which are now supplied from the last-named town.

**Eastbourne.**—YEAR'S WORKING.—The annual report of the borough electrical engineer (Mr. J. K. Brydges) for the year ended March 31st last, shows that the year's revenue was £62,895, as compared with £50,834 in 1919-20. Working expenses totalled £41,381, as against £29,101, leaving a balance of £21,514 (£21,733). Capital charges were heavier than those of the previous year, and the net result was a profit of £3,785, as against £5,786. Capital expenditure during the year amounted to £28,079 on account of extensions. The total number of units sold rose from 2,521,437 to 2,905,640.

**Elland.**—NEW STATION.—The plant installed to deal with a bulk supply of electricity from the Yorkshire Electric Power Co. has been put into operation. The installation comprises two 800-kW rotary converters, with transformers, and a 50-kW motor-generator set. Accommodation has been provided for an additional 500-kW rotary if, and when, this becomes necessary. The a.h.p. switchgear and cables have been provided by the Power Co.

**Glasgow.**—YEAR'S WORKING.—The accounts of the Electricity Department for the year ended May 31st, 1921, show revenue amounting to £1,311,951, an increase of £334,465 over the revenue of the preceding financial year. The working costs were £902,424, an amount which is £188,973 in excess of the previous year's costs. After providing for interest, sinking fund, and depreciation, amounting to £409,374, there remains a surplus of £151, contrasted with a deficit last year of £54,614. A statement issued by the Electricity Committee sets forth that in view of the adverse circumstances, due to shortage of plant (which was accentuated by the breakdown of new generators at the Dalmarnock Works in December last), and the drop in the consumption of electricity caused by the long dispute in the mining industry, the result of the year's operations is more favourable than might have been expected. The Electricity Committee, it is added, in view of the increased rate of interest on capital and other outgoings, coupled with the depressed state of trade, will have a difficult year to face, and the matter of the rates of charge will call for serious consideration.

**King's Lynn.**—YEAR'S WORKING.—The financial results of the working of the Corporation electricity department during the year ended March 31st last were as follows (the preceding year's figures are given in parentheses):—Total revenue, £16,659 (£13,807); working expenses and capital charges, £16,765 (£12,588); net result, £106 deficit (£1,219 profit). The number of units sold rose from 786,201 to 882,314.

**Kendal.**—YEAR'S WORKING.—The gross profit upon the electricity undertaking for the past financial year was £62, as against £336 in the previous year. The net result was a deficiency of £1,207, as against £962.

**Leigh (Lancs.).**—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking show that during the year ended March 31st last the income advanced from £26,263 to £33,603, while the total working expenses increased from £18,395 to £23,036. The units sold increased by 14 per cent., from 2,427,888 to 2,778,867. The general trade depression, more particularly in the textile industries, had an adverse effect on the latter portion of the year's operations; but, notwithstanding this, a gross profit of £10,566 was made. Interest, repayment of debt, and sinking fund charges absorbed £7,622, and after providing a further sum of £834 for all new meters bought during the year, the net result of the year's working was a profit of £2,109. Trade depression, strikes, and reduced hours of working had their effect on the load factor, which has gradually fallen from 33·3 per cent. in 1918 to 18·2 per cent. for the year under review.

**Llandovery.**—ELECTRIC LIGHTING SCHEMES.—Three separate schemes are suggested for the electric lighting of the town. The cost ranges between £6,237 and £8,000.

**London.**—BERMONDSEY.—The price of electricity is to be increased by 5 per cent.

**Mansfield.**—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £2,286 for feeders and distributing mains in connection with the housing scheme at Mansfield Woodhouse.

**Rickmansworth.**—OPPOSITION TO TIME EXTENSION.—The Urban District Council has informed the Electricity Commissioners that it still maintains its attitude of opposition to any further extension of the Rickmansworth and Chorleywood Electric Lighting Order, 1914, held by the Colne Valley Electric Supply Co., Ltd., adding that another authority is willing to supply the district. The company has informed the Commissioners that it has arranged for a supply to be taken from the sub-station at Pinner. This would necessitate the raising of a sum of £30,000.

**Rushden.**—BULK SUPPLY.—The Urban District Council has approved an application of the Northampton Electric Light Co. to supply electricity in bulk to the district, provided that the company undertakes to bear all expenses in connection with the laying of mains and the reinstatement of roads, &c.

**Sevenoaks.**—OVERHEAD TRANSMISSION.—The Rural District Council has granted permission to the Sevenoaks and District Electricity Co. to erect overhead lines in the district for the supply of electricity to villages in the Council's area.

**Teignmouth.**—AMENDED ORDER.—The Urban District Council has agreed to amendments to the Electric Lighting Order obtained in 1914 by Messrs. Purves, of Exeter, with a view to electricity being provided for the town of Shaldon, and the firm is to submit, as early as possible, a draft of the amended Order.

**Tisbury.**—ELECTRICITY SCHEME.—At a meeting of the United Parish Councils, last week, an electric lighting scheme for the town, submitted by Messrs. Edmundson's, the cost of which is estimated at £5,000, was accepted, and a Committee was formed for the purpose of promoting a limited company to carry out the scheme. Messrs. Edmundson's offered to take up half the ordinary shares (£2,500).

**West Riding.**—LAW COMMITTEE'S CRITICISMS.—The Law and Parliamentary Committee of the West Riding County Council submitted a report recently dealing with the Leeds and Bradford borough extension scheme inquiries and the recent inquiry at Leeds by the Electricity Commissioners into the three schemes for the Aire and Calder Electricity District. The Committee voiced the opinion that, in view of the present state of legislation in relation to electricity, the holding of the inquiry was premature, as the schemes in their essentials were *ultra vires*, and, therefore, beyond the authority of the Commissioners to confirm. The report stated that this fact was admitted by the Commissioners themselves, and that the Commissioners and the promoters alike are relying on future legislation. Having regard to these considerations and to the general financial situation in the country, the Committee expressed the opinion that all electricity schemes involving a change of ownership of large undertakings, consequent capital outlay, and probable additional burdens on the public purse, should be deferred.

## TRAMWAY AND RAILWAY NOTES.

**Bradford.**—ACCIDENT.—On July 11th a car proceeding along Church Bank, a steep incline, commenced to run backwards, the action of the brakes and the application of sand to the track failing to arrest its motion. As it was nearing a curve at the bottom of the incline, it collided with another car which acted as a buffer and prevented the runaway car's overturning in a similar manner to a car which ran away in 1907. The only casualties were slight injuries to five passengers.

**Brazil.**—Electrification of the Paulista Railway.—*Commerce Reports* learns that the initial order which has been placed in the United States by the American contractors for the electrification of the Paulista Railway comprises material sufficient for the first 45 km., the Jundiahy to Campinas section. Two of the four engines to be furnished by another American company are passenger locomotives of 2,000 h.p., weighing 121 tons each, one being capable of a speed of 104 km. on a 1·60 m. gauge. The remaining two are freight engines of 1,500 h.p., weighing 87 tons each, with a speed of 64 km. per hour. An overhead circuit of 3,000 volts direct current will furnish the energy. The entire electrification when completed will cover about 160 km.

**Cannock Chase.**—New Light Railway.—The London and North-Western Railway Co. is promoting a new light railway between Cannock Chase and Wolverhampton, a distance of 6¾ miles.

**Continental.**—Belgium.—As a protest against the reduction of their wages by 1 fr. (5d.) a day, the tramway workers of Antwerp went on strike on July 15th, and the tramcars ceased running entirely.—*The Times.*

**Glasgow.**—Annual Report.—Some interesting information is contained in the report of the Corporation Tramways Department for the year ended May 31st last. It is seen that although the coal consumption at the Pinkston generating station was reduced by 4,730 tons, the cost rose by £18,818, representing an increase of 7s. 7d. per ton. There was a falling-off in the number of passengers carried, although the car-mileage increased. The average fare per passenger rose from ·81d. to 1·28d., an increase of 58 per cent. The 1½d. fares showed the highest return (31 per cent.), while only a small proportion of the revenue was derived from fares of 3d. and above (·02 per cent.). The capital expenditure during the year was £88,576. The single-track mileage of the system was about 198 at the end of the year. The year's financial details were given in our issue of July 1st.

**Huddersfield.**—New Depot.—The new tramcar and omnibus depôt, erected at a cost of £51,690, was formally opened by the chairman of the Tramways Committee on July 15th. The accommodation includes a dining room, kitchen, lavatories, store rooms, and a large recreation room. The depôt is able to house 100 cars on 13 lines of track. The total area covered by the building is 5,113 sq. yd.

**London.**—L.C.C. Tramways.—The Highways Committee of the London County Council has had under consideration the advisability of promoting a Bill in the ensuing Parliamentary Session to obtain powers to construct a number of new routes, including lines along Farringdon Road, New Bridge Street, Holborn, and Charterhouse Street, and Tottenham Court Road, as well as a number of suburban extensions. The Committee has come to the conclusion that the Council would not be justified in promoting such a measure in the 1922 Session, owing chiefly to the opposition of a number of road authorities.

**Pontypridd.**—Sunday Services.—The Council has deferred consideration of an offer of £500 per annum from the Rhondda Tramways Co., which undertakes to provide the staff and power, for permission to run cars on the Council's system on Sundays.

## TELEGRAPH AND TELEPHONE NOTES.

**Germany.**—U.S. Mission.—It is reported that the American Mission which recently visited Berlin with a view to arranging for the laying of a direct cable between Germany and the United States has left without coming to an agreement.—*The Times.*

**The Telegraph Service.**—Foreign Telegram Rates.—The rates of charge per word for telegrams to the undermentioned places have been revised:—Brunei, Cuba, New Hebrides, East Africa (formerly German East Africa), and West Africa (French Colonies and possessions).

**The Telephone Service.**—Additional Expenditure.—A memorandum on the Telegraph (Money) Bill states that in accordance with the general practice of meeting capital expenditure of a reproductive nature out of loan money, provision for the development of the telephone system is made by advances of capital which are repaid by means of terminable annuities charged upon the Post Office Vote. The last Act was passed in 1920 (Telegraph (Money) Act, 1920) and authorised the issue of capital up to £10,000,000, which, owing to the heavy arrears that have to be overtaken, will be exhausted in October next. The present Bill authorises the Treasury to borrow a further £5,000,000 for telephone development. The actual expenditure in each year and the works to be carried out are subject to approval by the Treasury.—*Financial Times.*

The House of Commons went into Committee on the financial resolution in connection with the Bill on July 13th.

Mr. Kellaway, Postmaster-General, explained that the total capital expenditure out of telephone capital was, in 1920-21, £5,867,000. It was proposed for the present year to spend out of capital a total of £9,000,000. Of that, £2,350,000 was for trunk lines, £6,150,000 for new exchanges and subscribers' circuits, and £500,000 for sites and buildings. The money was principally required for contracts already made and for work which was now in progress. During the first five months of this year—the period during which the new tariff was first in operation—the Post Office received 1,400 orders a month for telephones in London and 2,500 a month in the provinces. They had to refuse a large portion of those orders, and there were at the end of May, 23,000 persons who required telephones whose applications could not be accepted because of the shortage of plant.

There was a great shortage of exchanges, and although new ones were springing up, a great number more were wanted, and the Government hoped to make considerable improvement if it got the £5,000,000 asked for. Recounting the progress made in laying underground trunk lines, he said that the three largest roads which were now approaching completion were (1) London to Manchester, which would be completed near the end of this calendar year; (2) London to Bristol and thence to Newport and Cardiff; and (3) London to Southampton with a spur to Portsmouth. The number of rural call offices opened in 1919 was 149; in 1920 it was 383, and in the first quarter of this year 116 had been opened and 105 were in course of construction. Arrangements were being made to open call offices at rural post offices where there was a telegraph line that could be converted to telephone purposes and a reasonable probability of business being done.

On the question of the new telephone tariff, he said that the number of subscribers who, as the result, had surrendered their telephones, was 23,000, 4·7 per cent. of the total number. During this time they had accepted 27,000 new subscribers, and had had to refuse 23,000. The bulk of the complaints he had received about the service related to the difficulty which those who desired to have the telephone installed found in getting it installed.

The resolution was carried by 99 votes against 26.—*The Times.*

London "Toll" Exchange.—The Postmaster-General announces that in order to relieve the pressure on the London Trunk Exchange, a new telephone exchange is in course of erection, and is expected to be opened towards the end of the summer. The new exchange will be situated near Fleet Street, and will be known as the London Toll Exchange. It is of an entirely new type, and has been designed so that the telephone traffic between London and the nearer provincial towns may be handled with greater dispatch. At the date of opening, the trunk lines between London and provincial towns which are within a distance of approximately 25 miles radius from the City will be transferred to the Toll Exchange from the London Trunk Exchange. The area served by the new exchange will contain about 300 exchanges and rural call offices, and will include the following towns:—Aylesbury, Luton, Dunstable, St. Albans, Watford, Brentford, Dorking, Leatherhead, Woking, Weybridge, Hertford, Ware, Maidenhead, Uxbridge, and Sevenoaks. Additional trunk lines are being provided, and when it is desired to put a call through to any of the towns which are included in the Toll area the public will ask for "Toll" instead of "Trunks," as at present. The local exchange will then connect the caller to the toll exchange, where the operator will have access to all the trunk lines, or toll lines, which are connected to that exchange. If all the lines to a particular town are engaged, the telephonist will record the details of the call, and ring the subscriber as soon as a connection can be given. Full details of the new service will be published in the Press, and an explanatory circular sent to each subscriber in the London telephone area in a few weeks' time.

**United States.**—Telephone Rates Cut.—The Public Service Commission recently ordered the reduction of 10 per cent. of the extra allowance of 20 per cent. for exchange service granted to the New York Telephone Co. by the old Commission last March. The telephone company in a statement says that this action will reduce the company's additional revenue from approximately $11,000,000 to $8,000,000, which will be sufficient for dividends, but not enough to give a fair return on the value of the property.—*Reuter's Trade Service* (New York).

**Wireless Telegraphy.**—Empire Chain.—The Sub-Committee of the Imperial Conference on Empire Communications, on July 14th, dealt with the subject of wireless telegraphic and telephonic communication throughout the Empire. It is understood, says the *Daily Mail*, that the Prime Ministers are unanimous about the importance of development in this direction, and that it remains to settle only the financial details.

Atmospheric Disturbances.—Mr. Marconi, who has just returned to London, announces that he has been for the last few weeks testing a new method of wireless reception developed by one of the company's engineers which has enabled him to receive continuously from the United States without being in any way interfered with by atmospheric disturbances which are particularly prevalent at this time of year, and more severe than usual in recent weeks in consequence of the abnormal spell of hot weather. Mr. Marconi regards this advance as of the greatest importance, for it enables a wireless telegraph service to be conducted, notwithstanding atmospheric disturbances, during the whole 24 hours and at high speed during the greater part of the time. He says that it would be difficult to exaggerate the practical value in commercial long-distance wireless telegraphy of this latest achievement.

## CONTRACTS OPEN AND CLOSED.

*(The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

### OPEN.

**Australia.**—TASMANIA.—August 15th. P.M.G.'s Department. Switchboard material. (July 8th.)

**Aylesbury.**—July 29th. Sewage works. Five electric motors and centrifugal pumps. Mr. W. H. Taylor, Borough Engineer and Surveyor (returnable deposit of £1 1s.).

**Battle (Sussex).**—July 29th. Union. New accumulator plates for 28 cells. Sizes 16½ in. × 10½ × 8½ in. (July 15th.)

**Belfast.**—August 22nd. Electricity Department. Required for the New Harbour power station. The manufacture, delivery and erection of one 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced-draught fans. Four fuel economisers. Two steel chimneys, with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (See this issue.)

**Bristol.**—August 15th. Corporation Electricity Department. The supply of one 3,000-kW, single-phase, 93-cycle, 2,200-V turbo-alternator and condensing plant and auxiliaries; and one 6,000-kW, three-phase, 50-cycle, 6,600-V ditto. (July 15th.)

**Chile.**—August 31st. Chilean State Railways. Emery and grind-stones, bolts, nuts, cotter pins, rivets, nails and screws, telegraph and telephone apparatus, chemicals, &c. (estimated value £44,000).*

It is understood that the representative of the Chilean State Railways in Paris (88, Boulevard St. Michel), has been instructed to obtain prices in the United Kingdom, and remit these by cable on the day previous to the opening of tenders.

**France.**—August 3rd. French State Railway authorities. Five electrically-operated capstans. Particulars may be obtained from the Service Electrique, 43, Rue de Rome, Paris.

**Manchester.**—July 29th. Electricity Committee. Five 2,500-kW rotary converters and other plant and switchgear. (July 8th.)

August 3rd. Electricity Committee. Low-pressure steam and water pipes and valves for Barton station. (July 15th.)

**Newport (Mon.).**—July 25th. Electricity Department. 750-kW rotary converter, transformer and switchgear. (July 8th.)

**New Zealand.**—WELLINGTON.—November 1st. Public Works Tender Board. One 200/250-b.h.p. oil engine and one 3-phase, 50-cycle, 190-kW at ·8 power factor, alternator, with exciter and switchgear.*

November 1st. Public Works Department. Fresh tenders for the supply and erection of steel pipe lines and fittings, required in connection with the Mangahao power plant, are now being called for. While the quantities, &c., of the material would appear to be substantially the same as those specified in the original call for tenders, it may be mentioned that some of the conditions applicable to the contract would appear to have undergone modification.*

**South Africa.**—Rand Water Board. September 28th. Contract No. 203. Tenders for supply, delivery, and erection at the Board's Intake Pumping Station, Transvaal Bank of Vaal River at Vereeniging of (1) Two vertical spindle centrifugal pumps, direct-coupled to electric motors, with all accessories, and (2) one 10-ton travelling crane. Also for main pumping station site, Vereeniging, two horizontal spindle centifugal pumps, direct-coupled to electric motors, with all accessories.*

**Warrington.** — August 9th. Corporation Electricity Department. Circulating pumps. (July 15th.)

*** A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.**

### CLOSED.

**Edinburgh.**—The contract for cables for the Portobello electric power station, mentioned in this column last week, was placed with Messrs. Watshams, of London, for cable manufactured by Messrs. Ateliers de Construction Electriques, Charleroi.

**Great Yarmouth.**—The Town Council Electricity Committee has placed an order for two sets of furnaces for Babcock boilers' with the Turbine Furnace Co., Ltd., of London.

**London.** — HAMMERSMITH. — Electricity Committee. Recommended :—

100 50-A house service fuses, three types, 14s. 6d., 12s. and 19s. 6d. each.—Lucy & Co., Ltd.
Conduit for mains extensions.—Doulton & Co., Ltd.
60 250-A switch panels, £26 2s. 6d. each.—Edison Swan Electric Co., Ltd.

STOKE NEWINGTON.—Electric Lighting Committee. Recommended :—

Overhead travelling crane, £360.—H. Morris, Ltd.
E.h.p. machine cables, £81.—W. T. Henley's Telegraph Works Co., Ltd.
Alterations to buildings, £1,170.—Goodall & Son.

**Trimdon (Durham) :—**

Electric light extension from Trimdon Grange Colliery to Trimdon Village, £1,414.—Cox, Walker & Co. (Darlington).

## NOTES.

**The Electro-Harmonic Society.**—The annual general meeting of the Society was held on Wednesday last at the Institution of Electrical Engineers. The report of the committee stated that during the past season 70 new members had been elected, six had died, 67 had resigned, and 28 had been removed from the register; the membership now numbers 603. The statement of accounts showed a deficiency of £23, and it was proposed, in order to maintain the standard of the concerts, to raise the annual subscription to 21s. A resolution was passed, expressing "high appreciation of the inestimable services rendered to the society" by the late Mr. T. E. Gatehouse, joint founder and hon. musical director of the Society since its inception 35 years ago.

**Electric Vehicles in U.S.A.** — According to the *Electric Vehicle*, the American Railway Express Co. has a fleet of 1,284 electric vehicles, forming more than half of its total fleet.

**Thermionic Discharges in Tungsten Lamps.** — The starting point of an investigation into the pulsating thermionic discharges which take place in evacuated tungsten lamps, which is described by Mr. A. G. Worthing in the *Journal* of the Franklin Institute, was the observation of peculiar, periodic, automatic changes in brightness of a tungsten ribbon filament in an evacuated lamp bulb. Several other lamps were investigated at the Nela Research Laboratory, only a few of which showed similar discharges, and none to the extent shown by the one in which the discovery was made.

All of the lamps tested contained a third insulated terminal, by means of which thermionic discharges in the lamp could be measured. Simultaneous observations of thermionic currents and of filament brightnesses by means of an optical pyrometer showed conclusively that the original variations noted in the filament brightness were directly connected with changes in the thermionic discharges in the lamp. These discharges may take place either from the filament to the insulated terminal, or from one leg of the filament to the other.

The tungsten ribbon filament in the lamp tested was V-shaped, with sides about 2·5 cm. long, and with an apex slightly truncated so as to give an approximately square surface 1 mm. on edge, which in the mounting faced the third terminal, also of tungsten. The lamp was evacuated in the ordinary manner. In one test a direct current of 8·2 A was used in heating the filament to a temperature of about 2,280° K. The negative terminal of a 44-V battery was connected to one of the leads to the ribbon filament through a voltmeter with 5,000 ohms resistance; the positive terminal of the battery was connected to the insulated terminal in the bulb.

The thermionic currents represented by the voltmeter readings showed discharges of a pulsating character in which, without any alteration of conditions by the experimenter, the currents rose from a moderately steady minimum, at first slowly and then with great suddenness, to a maximum value at least 4·8 times the minimum value. The period of the discharge [eight minutes] was constant for nine successive intervals to within 4 per cent. Small characteristic variations in the form of the curves were repeated also.

Different temperatures of operation, different applied voltages and resistances in the voltmeter circuit, yielded discharges differing in period, minimum and maximum current values, and ratios of maximum to minimum current values. Temperatures beyond a certain value and resistances below a certain minimum in the thermionic current circuit (other conditions remaining unchanged) tended towards pulsations which gradually diminished in intensity and disappeared, leaving a steady thermionic discharge.

No definite explanation is offered for this action. However, the blue glow discharges which were obtainable in the lamps used would seem to indicate that it might be connected with the residual gases in the lamps.

**Protection against X-Rays and Radium.**—The committee formed to inquire into the precautions that could be taken by those engaged in the use of X-rays or radium recently issued a preliminary report reviewing the state of present knowledge and stating the belief of the committee that the dangers can be entirely averted by suitable means. Details are given of the protective measures recommended to suit various conditions. Copies of the report can be obtained from the hon. secretaries of the X-Ray and Radium Protection Committee, care of Royal Society of Medicine, Wimpole Street, W. 1.

**The Measurement of Frequency.**—An heterodyne method of measuring frequency by comparison with a calibrated valve oscillator is described by Messrs. B. S. Smith and G. F. Partridge in the *Proceedings* of the Physical Society of London. The calibration is performed by means of two valve oscillators, which are capable of giving frequencies of, say, 1,000—/sec. and upwards. The frequency of the oscillators is raised alternately to give a beat note whose pitch is determined by comparison with a fork. Intermediate frequencies are found by interpolation on the calibration curve, and a method of checking the capacities of the oscillator condensers is described. For the measurement of acoustic frequencies the sounds are converted to alternating currents by means of a suitable transmitter. The method has been found very useful for determining the frequency of heavily damped steel diaphragms, and it would be possible to use it with a Galton whistle if some means of picking up the sound at such high frequencies was available.

**Are We Behind America?**—Those who maintain that this country is in a great many respects far behind the United States, may be interested in the *naïveté* displayed by the following *Reuter* note which seems to announce a discovery:—"The Street Railway Commission of this city (Detroit) is advertising for tenders for 50 'trackless tramcars,' a combination tramcar and omnibus. The new type of car is operated by electricity provided through the usual trolley, but runs on rubber tires and does not require any tracks. The pole will swerve to permit the car to pass any other vehicle in the street."

**Electricity in Agriculture.**—Electrical stimulation of plant growth is being tried "on a large scale" at the Rothamstead Experimental Station, and the results already attained were described on July 15th, when, on the invitation of Lord Bledisloe, chairman of the Lawes Agricultural Trust Committee, members of the county agricultural committees visited the station, which is near Harpenden. According to the *Daily Chronicle*, experiments have been proceeding for some time, some of which the visitors saw in operation. A pressure of 15,000 V is used in a network of wires 10 ft. above the ground over a growing crop of barley, and trials are being made with alternating and continuous discharges, and with negative and positive discharges. No actual decision has yet been come to, but the average increase of growth caused by electrical discharges over field crops is about 21 per cent. That, however, is just below what is necessary to make it an economical proposition. In other words, says the *Daily Chronicle*, the increase of the crop barely pays for the cost of the electricity. But the experiments are still being continued.

**Mining Dangers Research Board.**—The Board of Trade has set up a Mining Dangers Research Board to deal with the causes and prevention of mining dangers, and all communications on the subject should be addressed to Mr. Edward Fudge, at 46, Victoria Street, S.W. 1.

**Service Note.**—WIRELESS TELEGRAPHY COURSE.—No. 2 "A" wireless telegraphy course for officers of the Royal Corps of Signals will assemble at the Signal Training Centre, Maresfield, on October 3rd, and terminate on November 28th. This course is intended for officers and subalterns who have not attended a short wireless telegraphy course or the wireless telegraphy portion of the Royal Corps of Signals officers' qualifying course. Applications for vacancies should be forwarded by Commands to the War Office as early as possible.— *The Times.*

**The Industrial League and Council.**—This organisation, the object of which is the improvement of the relations between employers and employed, recently gave a dinner at the Holborn Restaurant to welcome Messrs. Ernest J. P. Benn, C.B.E., and Frank Elliott on their return from a five-weeks' visit to the U.S.A. In the absence of Viscount Burnham, the Right Hon. G. H. Roberts, M.P., president, was in the chair, and, following the usual loyal toasts, Messrs. Benn and Elliott gave their impressions of their visit to America.

**A Novel Magneto-Optical Effect.**—In *Nature* of July 14th, further particulars are given by Prof. Elihu Thomson regarding this effect, described in our issue of July 1st, page 3. Experiments have shown that the fumes from an iron arc form only a confused deposit on a glass slide in the absence of a magnetic field, but when a magnetic field is applied strings of brownish particles are deposited in striated form with brush-like tufts at the ends. These striæ on the microscope slide have the property of polarising light. Smoke from the arc enclosed in a glass flask and traversed by a beam of light shows increased luminosity in an alternating field; when the field is weak the steady luminosity is replaced by a flickering, which keeps pace not with the alternations of current in the magnetising coil, but with the cycles only. This effect is observed even at a distance of 12 ft. from the small magnetising coil. Messrs. R. Whytlaw-Gray and J. B. Speakman, of Eton College, in the same issue of *Nature*, describe similar experiments with various oxides dispersed in air, irregular chains or strings of particles being formed which, when examined with the ultramicroscope, exhibit rapid Brownian motion under molecular bombardment. In an electrostatic field the strings straighten out and arrange themselves parallel to the lines of force, and on reversal of the field they rotate through 180°. The particles appear to be held together by invisible threads.

**Educational.**—The REGENT STREET POLYTECHNIC (Engineering Department) announces the commencement of day courses (three years) for the Polytechnic Diploma on September 20th. Evening courses extending over a period of from one to five years, and preparing for the A.M.I.E.E. and the City and Guilds final examinations commence on September 26th.

SUNDERLAND TECHNICAL COLLEGE.—Mr. R. A. Bartram, a Sunderland shipbuilder, has presented 10,000 guineas to the Sunderland Technical College.

VIENNA.—The condition of the University is very serious. Many professorial chairs are vacant, their holders having abandoned them because they were unable to live on their pay. Austrian professors and men of science are migrating to Germany. It is possible that the University may have to close.—*Economic Review.*

**Appointments Vacant.**—The following vacancies are advertised in this issue:—Ledger clerk (£310-£390), for Hackney Borough Treasurer's Department (Electricity Section); assistant sub-station attendant (£4 8s. per week), for the Stoke Newington Borough Council.

**War Inventions.**—On Monday last the Royal Commission on Awards to Inventors began the hearing of a claim put forward by Messrs. Henry Hughes & Son, Ltd., for the invention of a magnetic compass for use on aeroplanes.

**Wounds Cured by Electricity.**—A method of destroying by electricity the microbes which infect wounds has been worked out and applied at the Royal Sussex County Hospital, Brighton. Dr. P. C. Collingwood Fenwick, surgical officer of the hospital, holds the opinion that electrical treatment will play an important part in combating disease in the future. The new method of bringing about a cure was described in a recent issue of the *British Medical Journal* by Dr. Fenwick. In one case a man had a very bad septic forearm, which did not improve under the usual treatment. The arm was placed in a porcelain bath filled with a solution of salt, and then electricity was passed through it. "The following day the arm looked very much cleaner. Each day it improved, and in 10 days with daily baths it was almost healed." Deep gunshot wounds were treated with equal success. Electric baths are being used with excellent results in the out-patient department of the hospital.—*Daily Mail.*

**Electrically-Propelled Ships.**—A paragraph which recently obtained considerable prominence in a number of daily papers deploring the lack of electrically-propelled ships in Japan was out of date before it reached this country, for the Toyo Kaisen Kaisha took over last May from the Asano Shipbuilding Co., of Yokohama, an electrically-propelled ship of nearly 9,000 tons carrying capacity. This is believed to be the first electrically-driven ship built in Japan. The turbines are steam-driven and the machinery was made by the Swedish Ljungstrom Co.—*Financier.*

**Setting a Recording Pyrometer for Cold-Junction Temperature.**—A recording pyrometer of the deflection or millivoltmeter type, on which it is necessary to set the galvanometer for the cold-junction temperature of the couples connected to it, often offers considerable difficulty to an accurate cold-junction setting because the lowest graduation on the scale or chart is seldom less than 75° F., while the actual cold-junction temperature is often as low as 50° F. When the cold-junction temperature is higher than the lowest chart or scale division the galvanometer can be set to this temperature as closely as the instrument can be read, but when the cold-junction temperature is lower than the lowest division this setting cannot be made so accurately, because there is a scale division on only one side of the setting to serve as a guide.

In many cases very little attention is paid to cold-junction settings; but for those users of pyrometers who endeavour to maintain their equipment as accurate as possible, the following method for setting deflection instruments when the cold-junction temperature is lower than the lowest scale division may be of some value:

Disconnect the instrument from the couple and set the galvanometer pointer on the lowest scale or chart division. By means of a potentiometer, Wheatstone bridge or other source of a small variable e.m.f. connected to the instrument, deflect the galvanometer an amount equal to the difference between the actual cold-junction temperature and the lowest scale division. With the source of e.m.f. unchanged and still connected to the instrument, reset the pointer to the lowest scale division by means of the zero adjuster. Then when the source of e.m.f. is disconnected from the instrument the zero or cold-junction setting will correspond with the actual cold-junction temperature as closely as the instrument can be read.—KIRTLAND MARSH, in *Chemical and Metallurgical Engineering.*

**Atmospheric Electricity as a Source of Energy.**—M. Hermann Plauson, on the basis of recently-conducted experiments, is of opinion that an inexpensive and unlimited supply of electrical energy may be obtained from the atmosphere. He has published a book on the subject, entitled *Gewinnung und Verwertung der Atmosphärischen Elektrizität* (Extraction and Utilisation of Atmospheric Electricity), published by Boysen and Massch, Hamburg, 1920. According to the *Schweizerische Chemikal-Zeitung*, he uses as an antenna a captive balloon having a metallic cover provided with a large number of pointed projections, or spikes, and allows it to ascend to a height of 1,000 or 1,600 ft. above ground. Positive electricity is thereby collected from the air and transmitted to the ground by means of a wire rope fitted with a spark gap, which, in turn, produces oscillations in the circuit. Electromagnetic waves are also produced in an additional circuit by resonance, and can be utilised to drive a specially-designed resonance motor. By inserting condensers and spark gaps the efficiency and safety against lightning are increased. M. Plauson obtained from one balloon, at a height of 1,000 ft., a supply of 17·28 kWh per diem, and with two balloons 81·6 kWh; he calculates that a battery of 10 balloons should give an annual supply of 210,000 kWh.—*Technical Review.*

**The Conductivity of Glass.**—In *Nature* of July 7th Mr. H. H. Poole gives an account of experiments which indicate that the conduction current through glass is not, as has been surmised, of an electrolytic nature, at ordinary temperatures.

**Fire.**—An outbreak of fire occurred, on July 14th, at the Dalzell Steel Works (Messrs. D. Colville & Sons) electrical station, Motherwell. It is supposed that a wire fused and ignited a wooden platform erected over the main cable system. The flames spread rapidly, damaging about 100 other cables of the main installation. For a time it was feared the engine-house would be involved, but the firemen succeeded in preventing the fire from spreading. The loss is estimated at about £1,500.

**Automatic Operation of Sub-station.**—The effectiveness of automatic sub-stations for light and power service was shown recently when trouble occurred on the system of the St. Paul Gas Light Company. The trouble began on one of the trunk lines and caused a momentary drop in voltage. The line was not cleared immediately, and all of the synchronous apparatus at the manual station was put out of service. The automatic sub-station cleared itself from the line but was restored automatically to service in a few seconds. It helped to take care of the direct-current network, which was immediately picked up automatically by a storage battery at the manual station. The voltage on the direct-current system dropped from 240 to 180. The contactors on the line panel of the automatic sub-station opened, cutting in resistance. This station continued giving service, however, through the resistance until enough of the manual station equipment was brought back into operation to restore the service to normal. The period of trouble lasted for about five minutes. This was the first automatic sub-station ever put into use in light and power work, according to the Westinghouse Electric & Manufacturing Co. The sub-station was placed in operation some months ago, and the result has been entirely satisfactory.—*Electrical World.*

**The Value of Meter Inspection.**—In an article in the *Electrical World* by Mr. A. L. Johnston, various instances are quoted of inaccurate registration of a consumer's supply. In one case the current transformers were of the wrong ratio, and for three years the meter registered only 50 per cent. of the load, involving a loss of $10,000. In another case the wrong gear train was used in a meter on a 400-kW load, under-registering by 50 per cent., and this condition existed for years. Two-phase supply with three-wire and four-wire connections offers openings for metering errors. In one instance a consumer challenged his meter reading, and the meter was tested and found correct; it was observed, however, that the meter recorded one-third of the normal load when no load was on. Investigation revealed the fact that on the consumer's side of the meter the connections were three-wire. This would not have affected the meter in the ordinary way, but it happened that another consumer was supplied from the *same transformer* on the four-wire system, and by accident one wire of each phase was interchanged with the other. The result was that the two phases on this consumer's premises were in series, but the connection of the two phases on the other consumer's circuit enabled the motors to run satisfactorily, while one meter ran at half speed and the other, which gave rise to the complaint, ran 50 per cent. fast. Lastly, on a load of about 500 h.p., the series coils of an indicating wattmeter were connected in parallel with the series coils of a watt-hour meter, and the latter ran about 50 per cent. slow for no less than 15 years before the error was discovered.

**Training Disabled Ex-Service Men as Electricians.**—In addition to the ordinary workshop practice in electrical manipulation, which forms a large part of the training of disabled ex-Service men at the Leeds Technical School, under the auspices of the Ministry of Labour, the men in training have recently completed the construction of a 20,000-volt transformer to work on the Leeds Corporation a.c. supply. This 2-kW transformer was of a special design to meet the requirements of the Leeds University, and has been delivered and tested in the Electrical Engineering Laboratory there. It was interesting to find that the testing pressure could be forced up to 100,000 volts, *i.e.*, five times the normal capacity, before discharge took place between the coil terminals. This result speaks well for the practical knowledge and skill of the instructors, and indicates careful and accurate workmanship on the part of the trainees who actually carried out the work.

Besides the armature winding section in which the above-mentioned work was done, there are also sections for training fitters and instrument-makers and electrical wiremen. In the electrical fitting section the trainees have recently constructed a commutator of unusual design. The brushes work on the inside instead of the outside surface. It is 19 in. in external diameter, and is built up of 299 bars.

In the installation section the wiremen in training have been given ample opportunity for carrying out practical work on a fairly large scale in various departments of the school requiring electrical extensions or alterations. In one piece of work of this kind, comprising 163 lights and four 3-phase motors, the official insulation test of the Corporation Electricity Department gave an "infinity" reading for the lighting system and 16 megohms for the motor circuits. This also indicates very careful attention to details on the part of the trainees.

**A Self-Starting Synchronous Motor.**—A synchronous motor which will start and come up to speed under load was developed recently. It makes use of a new principle of design in a squirrel-cage starting winding. For this winding copper or brass tubing is used, instead of solid bars. Obviously the outer diameter may remain the same for all standard designs, this feature in connection with standard manufacture eliminating the necessity of using various index dies for the pole punchings. The resistance, however, of the tubular conductor may be varied over a wide range by changing the wall thickness of the tubing. Inside this tubing are embedded conductors of magnetic material, such as iron or steel. The bars are fastened to end-ring segments, which also serve as upper coil supports for the field coils. These end-ring segments, forming a continuous ring, are connected together between poles by the use of a split sleeve which fits into holes drilled on the job when the poles are assembled. A taper pin is driven in to ensure contact and mechanical stability.

At starting the frequency in the squirrel-cage winding is the same as in the line, but as the rotor comes up to speed the frequency will fall off to zero. Owing to the skin effect the inner bars of magnetic material will not be effective at starting, but a high starting torque is established if the copper or brass tubing has the proper resistance. As the rotor, however, is accelerating, the inner conductors will become effective and in the neighbourhood of synchronous speed will furnish a high pull-in torque in addition to the rather small torque furnished by the tubing at that speed. It is possible by changing the squirrel-cage winding to make the torque characteristics adapt themselves to various applications of synchronous motors.—*Electrical World.*

**The Use of Coke-oven Gas.**—The Board of Trade has recently endeavoured to obtain information regarding the quantity of coke-oven gas produced in the United Kingdom and the proportions used for various purposes, or entirely wasted.

The output of gas per ton of coal carbonised varies from 9,000 to 12,000 cubic feet, 10,000 cubic feet being the average quantity evolved. The calorific values vary from 420 to 550 British thermal units gross per cubic foot. A total quantity of 37½ thousand million cubic feet per annum appears to be utilised by the coke-oven proprietors for purposes other that the heating of the coke-ovens, and a total of 7½ thousand million cubic feet per annum, including upwards of 805 million cubic feet run to waste, is at present available for disposal.

**Indicators for Heating Appliances.**—The *Industrial Australian and Mining Standard* states that Mr. G. H. Lofts, Hobart district manager for the State Hydro-Electric Department, Tasmania, has designed an indicator for electrically heated devices consisting of a buzzer, the sound produced by which can be varied as desired. The advantages claimed for the devices are: (1) That only about 1/15th of the energy used by a lamp indicator is required for the buzzer type, (2) cost of mantenance is less than with the lamp indicator, (3) the apparatus may be fixed in the flexible cord or anywhere else in the circuit; it may also be made inoperative, in the case of attachment to a laundry iron, when the iron is in use.

Mr. Lofts has also designed an improved cut-out arranged to open the circuit when an iron reaches a predetermined temperature.

**Canals and Waterways.**—The Committee on Inland Waterways has submitted a second interim report to the Minister of Transport, in which it states that "certain important waterways, were they given a fair chance and put under unified and competent management, would be capable of playing a very important part in the transport of the country. The Committee divides the principal inland waterways into seven groups or systems, and suggests that a beginning should be made with one or two only of the groups, selecting those which present the best prospect of success with the least amount of capital expenditure. With this in view, the group comprising the River Trent and its connections is selected as pre-eminently suited for the first experiment.

In the *Financial Times* of Tuesday last the proposition was fiercely attacked by Mr. Harold Cox as a "sentimental fad."

**Electric Haulage on Canals.**—At the recent inland navigation congress, held at Rouen, M. Du Bousquet, of the Société de Halage Electrique (Lens Mining Co.), and M. Tumerelle, of the State Department of Roads and Bridges, presented a joint report on electric haulage on canals. The report stated that after having been established before the war in the coalfield in the North, electric haulage had been introduced by the Government since the Armistice on the lateral canal to the Oise, the canal of Saint-Quentin, and the Haut-Escaut, the total length worked being 86 miles. A trial has also been made in the Foug tunnel, on the Marne canal to the Rhine, the results responding to expectations.

**Use of Electricity in Scottish Coking Seams.**—On June 1st, 1920, an explosion occurred in the coking coal seam of the Auchengeich Colliery, Lanarkshire, belonging to James Nimmo and Co., Ltd., by which two men were killed and five injured. The explosion was caused by the ignition of gas, due, as was alleged, to a spark from the electrical coal-cutting machine which was in use in the seam. The Divisional Inspector of Mines gave the mineowners notice that the use of electricity in the coking seam would, on account of the risk of explosion of gas or coal dust, be dangerous to life, and required them to desist from using electricity in the seam at, or within, 50 yards of the face for coal-cutting or for any purpose other than shot firing or obtaining light by means of electric safety lamps. The owners refused to comply with the notice, being of opinion that the use of electricity in the coking coal seam at, or within, 50 yards from the face would not involve danger to life. The Home Office thereupon, in terms of the Coal Mines Act, applied for the appointment of a referee to determine the question, and Mr. J. Gemmell, mining engineer, Edinburgh, was appointed by the Reference Committee. The hearing has now taken place. Evidence was led on behalf of the Inspector of Mines and of the owners, and, after hearing counsel, Mr. Gemmell said he would take time to consider his decision.—*Iron and Coal Trades Review.*

## INSTITUTION NOTES.

**Institution of Electrical Engineers.**—ROYAL CHARTER.—Notice is given in the *London Gazette* of July 15th that a petition has been deposited praying for the grant of a Charter of Incorporation to the Institution, and that all petitions for or against such grant should be sent to the Privy Council Office, Whitehall, on or before August 1st.

A.M.I.E.E. EXAMINATION.—It is proposed, if a sufficient number of candidates make application, to hold an examination for Associate Membership in London and at other places (at home and abroad) in October, 1921. An entry form and full particulars may be obtained on application to the Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C. 2.

WESTERN CENTRE.—On Monday next the annual meeting will be held at Hereford. Afterwards places of interest will be visited, under the guidance of Mr. W. T. Kerr, city electrical engineer

**Association of Consulting Engineers.**—At the last meeting of the Committee of the Association of Consulting Engineers, Mr. W. Vaux Graham was unanimously elected chairman for the ensuing year.

**Electrical Power Engineers' Association (Southern Division).**—A lecture on "Boiler Design: Latest Developments," is to be delivered by Mr. J. Cauthery, at Central Hall, Westminster, S.W. this evening (July 22nd), at 7 p.m.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

THERE was an exceptionally large attendance in the Deputation Room of the G.P.O. on the 13th inst., when Sir William Noble, on behalf of the whole staff of the Engineering Department, offered a handsome parting gift to MR. ARTHUR J. STUBBS, assistant engineer-in-chief, on his retirement. Sir William expressed the feeling of a loss of a personal friend which they all had on this occasion, and said it was peculiarly gratifying to realise that Mrs. and three of the Misses Stubbs (all of whom, with Master Cuthbert, were present) had such a practical share in the gift. Mr. Stubbs entered the Engineering Department 41 years ago, after training

*Photo by* [*C. Vandyk.*

ARTHUR J. STUBBS.

as an architect. He became first-class technical officer in 1899; superintending engineer in 1902, and was promoted to his present position in 1907. In thanking his colleagues for their most generous gifts, Mr. Stubbs claimed that the five bicycles were really a far more sentimental gift than some of them realised—the life-long memory of his little daughters that the delight of their first bicycle was given by their daddy's office friends, was finer than the possession of a silver teapot; and, although Mrs. Stubbs was by no means above a love for pretty jewellery, the ownership of the highest-grade and sweetest-toned gramophone that she had ever heard, was a surprise gift that gave her a pleasure quite beyond expression. The beautiful silver casket, with an address and signed cards of the contributors, would form the heirloom that so many of them desired, and that he and his family would value and treasure as a perpetual token of the friendship of those who were so numerously represented at the meeting.

At the same gathering a handsome pedestal-type gramophone was presented by the engineer-in-chief, the assistant engineers-in-chief, the staff engineers, the superintending engineers, and a few others to MR. A. MOIR, O.B.E., to whom the main presentation from his own staff as superintending engineer of the London District was made early in June, as recorded in the ELECTRICAL REVIEW of 10th ult. Mr. Moir can claim to be the "father" of the engineering department, inasmuch as he entered it in 1878. In a brief speech subsequently, Mr. T. B. Johnson, superintending engineer, testified to the general esteem of the superintending engineers for their *doyen* who was always their friend, and also made feeling reference to the recognition by the whole of the staff that Mr. Stubbs had himself (as he said he advised a junior lately) not only worked hard and played the game, but that he had always been characterised by the exhibition of the highest principles in all his relations.

In a farewell letter to the staff, Mr. Stubbs says "consciously I have not an enemy, and consciously I feel assured of a host of friends. It is splendid to be able to say this at the end of a long official career." The many-sidedness of the Post Office engineer's interests is indicated by the fact that besides close acquaintance with telegraphs and telephones, staff organisation and engineering accounting, Mr. Stubbs has a wide experience in the construing of contracts, and an expert knowledge of fire alarms. He has worked on "safety first" principles in their post office application, and has taken up "welfare" work; he is a representative of the Post Office on the Interdepartmental Patents Committee, and on several committees of the British Engineering Standards Association, and has been a British delegate on the International Electrotechnical Commission. He is also a member of the Committee of the Decimal Association.

MR. ALEX. R. MCCALLUM, B.Sc., A.C.G.I., who is leaving the London Electric Railway Co. to take up an appointment on the staff of Messrs. C. P. Sandberg, of Westminster, has had a wide experience in connection with electric traction; serving a pupilage at Messrs. Dick, Kerr & Co.'s Preston Works, he joined the London United Tramways in 1908, and later took a post on the staff of the London Underground group, becoming, in March, 1915, chief assistant to the mechanical engineer; in this capacity he had charge of all rolling stock, workshops, and running repairs to trains, gaining unique experience in these matters. In the autumn of 1919, in company with three other officials, he visited the United States to make a study of electric traction conditions in that country.

CAPTAIN W. HALL, Tyne Electrical Engineers, having attained the age limit, is placed on the retired list of the Territorial Force, and retains at the same time his rank of captain. Captain Hall was appointed to No. 1 Company in October, 1914, and was promoted captain in June, 1916. LIEUT. R. F. WOOD-SMITH, London Electrical Engineers, has retired under the age-limit rule after serving with the corps since the opening of the late war, a portion of which time he held the acting rank of captain, which rank has been given him on retiring after five years' service. LIEUT. R. H. SMITH, of the same corps, which he joined during the war, has been similarly retired.

The Hammersmith Electricity Committee has appointed MR. F. V. JORDAN, of Biggleswade, to the position of assistant mains engineer, at a salary of £412 per annum.

The Electric Lighting Committee of the Stoke Newington

*Photo by* [*Elliott & Fry.*

ALEXANDER MOIR.

Borough Council recommends that the salary of MR. H. L. LARGE deputy borough electrical engineer, be increased to £385, as from August 1st.

MR. C. H. DURRAD LANG, director of Messrs. Lang & Squire, Ltd., of Acton, was married on July 20th, to Miss E. M. Talbot White, daughter of Mr. Geo. H. White, of West Heath Drive, Hampstead.

The Rhyl Urban District Council has appointed MR. E. B. WRIGHT temporary electrical engineer to the end of the present financial year. He is taking the place of his brother, who has been ill, and is taking a year's rest.

MR. H. H. SPENCER has been appointed assistant manager of the Glasgow Branch of Messrs. Crompton & Co., Ltd. Mr. Spencer has been connected with Messrs. Crompton for a number of years, and served throughout the war in the Royal Engineers. He has been hon. secretary of the Chelmsford Engineering Society for some considerable time.

**Obituary.**—MR. A. FALLEN.—Mr. Albert Fallen, a member of the staff of the Kaministiquia Power Co., West Fort William, Canada, recently received a 22,000-V shock, from which he died the following day. He was 45 years of age.

The daily Press announces the death, in his 53rd year, of MR. ALBERT CHORLEY ROGERSON, C.B.E., general manager of Beyer Peacock & Co., which took place suddenly at Cleveleys, on Sunday morning.

**Wills.**—MR. JOHN MELVILL BOUSTEAD, late of Boustead Bros., and a director of several companies, including the Colombo Electric Tramways and Lighting Co., left £24,000.

## REVIEWS.

*Induction Coils.* A Practical Manual for Amateur Coil Makers. By G. E. BONNEY. Pp. x+198; figs. 80. London: Sir I. Pitman & Sons. Price 6s. net.

This is a sound, useful little work, which carries out its intention of helping amateur coil makers who have no elaborate appliances. Perhaps the title should not lead us to expect a very full account of the accessories, but the part dealing with interrupters seems rather meagre, while that relating to batteries is disproportionately full, especially in view of the growing facilities for the purchase and charging of accumulators; few amateurs would want descriptions of so many different types of cell and the effects of the speed of interruption and of the time of prolongation of contact might receive fuller attention at the expense of this section.

It is refreshing to find in a popular book of this type a much clearer indication of the function of the condenser than is generally given; though anything like abstruse theory is carefully avoided it is possible to obtain a good elementary idea of this very vital matter.

*Induction-coil Design.* By M. A. CODD. Pp. 238+59; figs. 165. London: E. & F. Spon, Ltd. Price 21s. net.

Of two or three books on induction-coils which have reached us recently, that by Mr. M. A. Codd will appeal most to the more highly specialising reader.

It is by far the most ambitious in scope, and embodies an admirable attempt to elucidate the theory of the subject by means of an exhaustive series of oscillograms that reveal many interesting facts. In some cases, however, it is not very easy to follow the interaction between primary and secondary phenomena, and the time or time-scale displacement which seems to cause disagreement between e.m.f. and rate-of-change of flux in corresponding curves in fig. 6 would be less confusing were it adjusted or its cause explained. The book is thorough and systematic, and should prove valuable to all designers and makers of coils except those whose long experience has been crystallised in set forms and methods.

Such blemishes as are evident suggest the need for a little scientific polishing, as, for instance, on p. 35, where peak-voltages are given as 1,013 volts and 1,945 volts—figures which claim an accuracy of 0.1 per cent. in the measurement of quantities which are only capable of rough evaluation.

The only feature which makes us really sad is fig. 67. This is called a "filing" figure, but by some interpenetrant or fourth-dimensional method shows the directions of the filings in the interior of the magnet. If, however, we even allow these lines to be conjectural, we are not comforted, for their interior distribution brings us to the startling conclusion that a magnet is divided longitudinally into two regions in which the magnetisation is opposite in sense or direction, so that a secondary coil wound on the middle of the magnet would enclose a flux having zero effective value.

The author describes bald patches at the poles, and draws them as neat circular areas where there are presumably no lines of force at all.

We hope this figure will not give readers the bad dreams which haunted us after seeing it.

On constructional detail the book seems thoroughly sound and most valuable; it represents great and painstaking labour, and is a frank disclosure of workshop methods about which some makers pretend to draw an unnecessary veil of secrecy.

In conclusion, we may say that there are valuable tables and curves and a small bibliography—a welcome feature which we note with satisfaction.

The absence of any kind of index is a blemish which we do not expect to find in a modern technical publication, especially when, as in this case, the table of contents is meagre.

## NEW COMPANIES REGISTERED.

**Malleable Fittings, Ltd.** (175,707).—Private company. Registered July 13th. Capital £500 in £1 shares. To take over the electrical conduit fittings business carried on by Miriam Ravenhill at Brantford, as "M Hill & Co." The directors are: J. T. Forrester, 65, Stanley Road, Hounslow, engineer (managing director); Miriam Ravenhill, 103, Harthorn Road, Isleworth, manufacturer. Secretary: W. Parker. Registered office: 30, Catherine Wheel Yard, Brantford.

**Lowke & Sons, Ltd.** (175,681).—Private company. Registered July 12th. Capital £10,000 in £1 shares (5,000 10 per cent. cumulative preference). To take over the business of an electrical, agricultural, domestic and general engineer and boiler maker, carried on by J. T. Lowke, at Kingswell Street, Northampton, as "Lowke and Sons." The subscribers (each with one ordinary share) are J. T. Lowke, 13, Kingswell Street, Northampton, engineer; H. A. Bassett-Lowke, 18, Albion Place, Northampton, engineer. The subscribers are to appoint the first directors. H. A. Bassett-Lowke is the proposed managing director. Registered office: 18, Kingswell Street, Northampton.

**Ross & Company (Electric), Ltd.** (11,798).—Private company. Registered in Edinburgh July 13th. Capital £20,000 in £1 shares. To acquire the business of Ross and Company, manufacturers and agents for electrical accessories and supplies, 62, Robertson Street, and 399, Parliamentary Road, Glasgow. The first directors are: J. Smith, 62, Robertson Street, Glasgow, electrical manufacturer and supplier; A. Thomson, junr., 62, Robertson Street, Glasgow, electrical engineer; E. F. Smith, 62, Robertson Street, Glasgow, electrical manufacturer and supplier. Qualification: 100 shares. Registered Office: 62, Robertson Street, Glasgow.

**Sussex Electricity Supply Co., Ltd.** (175,686).—Private company. Registered July 12th. Capital £20,000 in £1 shares. To take over the business carried on by W. Simms and E. Prior as the "Sussex Electricity Supply Co.," and to carry on the business of electrical engineers, fitters and suppliers of electric current and energy, etc. The first directors are: H. W. Humphries, 61, Woodcote Valley Road, Purley, Surrey; W. Simms, Hamilton Road, Felixstowe, Suffolk; E. Prior, 30, Church Road, Burgess Hill, Sussex; A. R. Hunt, 30, Church Road, Burgess Hill, Sussex. Qualification £50. Remuneration as fixed by the company. Secretary: G. Clough. Registered Office: 85, Gracechurch Street, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Automobile Electrical Repairers, Ltd.**—Particulars of £1,000 debentures, authorised June 13th, 1921; present issue £500; charged on the company's undertaking and property, present and future, including uncalled capital (if any).

**Drake & Gorham, Ltd.**—Mortgage and Land Registry Charge on 36, Grosvenor Gardens and 36, Grosvenor Gardens Mews, South, both dated June 20th, 1921, to secure £12,000. Holders: North British and Mercantile Insurance Co., Ltd.

**Metropolitan Electric Supply Co., Ltd.**—Trust deed dated July 5th, 1921, securing £500,000 7½ per cent. extension debenture stock, 1921, charged on the company's undertaking and property, present and future, including uncalled capital subject to debenture stock covered by trust deeds dated July 20th, 1894, July 4th, 1899, and May 15th, 1917. Trustees: British Trusts Association, Ltd., 33, Bishopsgate, E.C.

**Johnson & Phillips, Ltd.**—£175,000 satisfied and new debenture stock for £350,000 issued. A memorandum of satisfaction in full on July 1st, 1921, of trust deed dated September 28th, 1905, securing £175,000, has been filed. Particulars of £350,000 first mortgage debenture stock, authorised March 24th and covered by trust deed dated July 1st, 1921, has also been filed, the whole amount being now issued. Property charged: Certain lands, premises, easements, rights and privileges in Charlton, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd., and London General Investment Trust, Ltd.

**James Keith and Blackman & Co., Ltd.**—Satisfaction in full on May 15th, 1921, of debentures dated October 29th, 1901, November 3rd, 1902, March 31st, 1903, and May 30th, 1913, securing £900.

**Northampton Electric Light & Power Co., Ltd.**—Issue on June 16th of £250 and July 5th, 1921, of £200 debenture stock, parts of a series already registered.

**A. Robinson & Co., Ltd.**—Debenture dated June 14th, 1921, to secure £10,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: James Scott, Ltd.

**Southern Brazil Electric Co., Ltd.**—Particulars of £176,500 8 per cent. notes, debentures (including £146,500 already registered) authorised June 24th, 1921. Present issue £28,000, charged on the company's undertaking and property, present and future, including uncalled capital (subject to £750,000 1st mortgage debentures).

**Cleveland & Durham Electric Power, Ltd.** (89,539).—Return dated May 24th, 1921. Capital £700,000 in £1 shares (350,000 preference and 350,000 ordinary), 333,705 preference and 157,600 orinary shares taken up. £411,003 paid. £80,302 considered as paid. Mortgages and charges, £384,906.

**Brompton & Kensington Electricity Supply Co., Ltd.** (25,913).—Return dated March 31st, 1921. Capital £300,000 in £5 shares (20,000 preference and 40,000 ordinary), 5,501 preference and 34,499 ordinary shares taken up. £195,000 paid. £5,000 considered as paid. Mortgages and charges nil.

**Urban Electric Supply Co., Ltd.** (57,986).—Return dated May 4th, 1921 (filed May 5th). Capital, £640,000 in 80,000 ordinary shares of £3 each, 50,000 preference shares of £5 each, and 150,000 undenominated shares of £1 each. 80,000 ordinary and 50,000 preference shares taken up. £490,000 paid. Mortgages and charges, £443,952.

## CITY NOTES.

**English Electric Co. of Australia, Ltd.**

The *Sydney Daily Telegraph* for May 17th stated that when moving the adoption of the report at the annual meeting, Mr. A. A. Stewart expressed the reluctance with which the board had recommended the passing of the dividend. During the year under review, he said, 10 per cent. had been more than earned, and they had large balances in cash. Commitments, however, were heavy, and these were not times in which they were warranted in looking to their bankers, accommodating as they had been in the past, for more than temporary assistance in the carrying out of their contracts. They must, therefore, provide out of share capital or debenture loan what was necessary to complete and equip their new workshops. The estimated cost a year ago was £150,000, to be provided by the issue of debentures. Only £113,600 had been issued at date of balance. The shops would cost £190,000, or about 25 per cent. more than estimated, and, including unremunerative expenditure at Concord, a total of £201,000. To meet a further expenditure of £90,000 they had at date of balance £80,000 less £11,000 owing to cash creditors, leaving £69,000. A dividend of 10 per cent. and one-tenth of profits to "A" ordinary shareholders would have reduced this to £43,000, or £47,000 less than their requirements. The handling of contracts totalling £500,000 would probably lock up a considerable sum, and in that connection when entering into the agreement with the English Electric Co., Ltd., they had reason to believe that they would receive substantial help from them, if necessary, in capital. They had been disappointed. They were not expected to exercise their option of 100,000 shares at 25s. Standing on the letter of their agreement, they could prevent the Australian com-

pany from making any increase of capital except by consent. Assuming that they could arrange with their London associates they had had under consideration the raising of £50,000 or £60,000 additional capital by the issue of new shares, either with or without preferential rights. The payment of a dividend must, therefore, be postponed until they got the consent of the "A" ordinary shareholders. They wanted to make a fresh issue and pay the usual dividend. The financial situation dominated everything, but he knew of no engineering business in a sounder position.

**Electric Supply Corporation, Ltd.**

Mr. J. G. B. Stone (chairman) presided at the nineteenth annual general meeting, held at Salisbury House, E.C., on July 14th. The directors' report then submitted showed that the gross earnings for the year ended December, 1920, were £82,665, an increase of £22,580 for the year. The sum taken into net revenue account was £17,791, against £13,519 for 1919. After paying interest on debenture stock, and the actual cost of the year's repairs and renewals, and including the balance brought forward, there is a surplus of £3,403, out of which £3,000 is to be put to the reserve fund and £403 carried forward.

| Year. | Equivalent in 32-W lamps connected. | Units sold. | Gross earnings. | Profit, including dividends on investments. |
|---|---|---|---|---|
| 1919 .. | 298,857 | 6,932,455 | £60,085 | £13,519 |
| 1920 .. | 322,957 | 7,897,272 | 82,665 | 17,791 |

The Hendon Electric Supply Co., Ltd., distributed a dividend and bonus of 15 per cent. for 1920, and the Dumbarton Burgh & County Tramways Co., Ltd., a dividend of 5 per cent. upon its ordinary shares. The total amount received is included in these accounts. The following generating stations belonging to the company were complete, and in working order on December 31st, 1920:—

LAMPS CONNECTED. (EQUIVALENT IN 32-W LAMPS).

| | 1920. | Increase. |
|---|---|---|
| Chelmsford .. .. | 45,775 | 3,741 |
| Jedburgh .. .. .. | 7,281 | 876 |
| Melrose .. .. .. | 7,200 | 931 |
| Dalkeith .. .. .. | 11,904 | 994 |
| Dollar .. .. .. | 4,062 | x74 |
| Totnes .. .. .. | 8,609 | 552 |
| Exmouth .. .. .. | 27,854 | 2,927 |
| St. Andrews .. .. | 18,489 | 4,927 |
| Hitchin .. .. .. | 19,591 | 3,598 |
| (a) Dumbarton .. .. | 125,242 | 3,962 |
| Falmouth .. .. | 26,400 | 2,413 |
| Total .. .. | 322,957 against 298,857, a net increase of 24,100. | |
| (b) Hendon, Jan. 10th, 1908 .. | 215,136 | 252,061 | 36,925 |
| (c) Dawlish, June 26th, 1911 .. | 7,116 | 10,700 | 3,584 |
| (d) North Berwick, Sept. 15th, 1913 | 3,787 | 5,032 | 1,245 |

(a) These figures take no account of the supply to the Dumbarton Burgh and County Tramways which used 640,240 units in 1920. The Company holds 29,840 £1 Ordinary Shares (out of 80,000 issued) in the Dumbarton Burgh and County Tramways Company. The traffic receipts of the Tramways were £41,549 in 1919 and £42,721 in 1920.

(b) The Company holds 4,169 £5 Ordinary Shares in The Hendon Electric Supply Co., Ltd.

(c) The Company holds 356 £1 Ordinary Shares in the Dawlish Electric Light and Power Co., Ltd.

(d) The Company holds 1,000 £1 Ordinary Shares in the North Berwick and District Electric Light and Power Co., Ltd.

At the meeting, the chairman, in comparing the figures for the two years, said that the increase in gross revenue was £22,580, apart from the income from investments, which showed a small decline of £51. The revenue figures were largely increased owing to the rise in the price of coal, which in the case of their large contracts they were able to hand on to their consumers. For the same reason they found their working costs had increased £18,256, an increase which, although principally due to coal, was also due to higher wages. They took into net revenue account £17,792, an increase of £4,272 over last year. If, as on previous occasions, he excluded the Dumbarton undertaking and the return on investments, the gross profit on the other undertakings was £6,836, an increase of £3,887 over 1919. In turning to the net revenue account, they had to deal with an adverse comparison. Repairs which, as in former accounts, were excluded from the revenue account and brought into net revenue account, amounted to £7,196, an increase of no less than £3,935 over 1919. The cumulative effect of the increased cost of repairs, interest charges, and the reduced carry forward was that the balance on this account was reduced from £3,621 to £3,403, which was the net result of operations for the year 1920. These figures showed that their position would have been materially better than in 1919 had it not been for the increased cost of repairs. The cost of repair work was somewhat higher in 1920, and they had had a good deal of battery renewal to carry out at very high prices. They had still got a good deal of battery repair in front of them. Apart from the batteries the principal repair items had been machinery and switchboards at Chelmsford and to a lesser extent in the other towns. The credit balance on the Dumbarton undertaking which was £5,644 in 1919 had increased to £6,080, and if as they hoped there was a settlement of labour troubles in the ship-building industry and a revival in trade, they anticipated a considerable increase in their business in this town, as they had secured additional important contracts. Last year he gave some figures showing the output and increase in costs in their towns other than Dumbarton, which was excluded, as they were there taking a bulk supply of electricity and were not so directly interested in the cost of production. Similar figures for 1920 were as follows, the comparison being with 1914, which they considered as a pre-war basis. In 1914 they supplied 1,416,534 units, and in 1920 1,743,652 units. The increase in the average selling price was 50 per cent. The cost of production had risen 149 per cent. Coal which cost £5,040 in 1914 cost £17,213. Stores costing £565 in 1914 cost £1,417. Wages costing £4,385 cost £11,960 in 1920. The capital account showed an increase of £11,098 during the year. Apart from small mains extensions, meters, and such like, the principal increases had been at Chelmsford and Dalkeith on plant, and in Dumbarton on high-pressure mains for power supply. There was an item of £14,161 realised loss on the Dumbarton plant. This stood at £14,423 in 1919. They had been able to reduce it by selling some more of the disused plant, and since the close of the year further sales had been effected. With regard to their maximum rates, they had now got the bulk of their undertakings in a satisfactory position, having obtained revised rates without any condition attached thereto, such as was required under the Temporary Increase of Charges Act, and under the existing law these revised rates could not be altered for five years as from the beginning of this year. The maximum rate was now 1s. per unit in all towns except St. Andrews, where it was 10d., Dumbarton 6d., Exmouth 8d., and Hitchin 7d. He pointed out last year that in the case of Exmouth and Hitchin they were excluded from getting the proper increase owing to the form in which they carried on these undertakings. The new Electricity Act would, if passed, relieve them, he thought, from this incubus. Their investments in the Dumbarton Tramways and in Hendon had again yielded them dividends of 5 per cent. and 15 per cent. respectively, and once more he regretted to report that the Dawlish and North Berwick companies had made no distribution. The sum of £62,213, representing the cost of their investments, showed a reduction due to their having disposed of some of their Hendon investment in order to provide capital to meet the requirements of their undertakings, and the investments now included £11,124 of their own debenture stock. The average return on their investments was maintained at just over 7¼ per cent. A large proportion of this was free from income tax. Reviewing generally the position of the company, it was encouraging to note that apart from the item of repairs, their position was considerably improved, and they had reason to think that the repairs charges would be materially reduced when they had got over the arrears due to the war and the high cost of such work. There was no doubt that engineering prices were now coming down. As to their own cost of production, the high-water mark in wages had now been reached, and the tide was falling with the fall in the cost of living, but he wished they were more certain as to the trend of coal prices. They were now higher than they had ever been, and it was not known what course they would take. There was still an active demand for electricity.

Sir HOME GORDON seconded the motion, and it was carried without discussion.

**Crompton and Co., Ltd.**

The annual meeting was held on July 14th at Winchester House, E.C. Mr. A. A. Campbell Swinton, the chairman, who presided, said that in the balance sheet freehold land and premises had increased to £357,167, as compared with £264,655 last year. This further expenditure appeared owing to the completion of the main buildings and the plant therein and the enlargement of premises at Chelmsford. They began to feel the benefit of these increased facilities about January, and they were, therefore, able to speak of these benefits in the light of experience of their value. As to stock in trade, there had been a heavy fall in the prices of nearly all of the commodities which were used in their business, and the directors, therefore, had thought it wise to write down this figure in the balance sheet, and the amount therein shown was a very conservative one. A large allowance had been made for bad debts, but the bad debts actually incurred were considerably less than the reserve set aside. Investments were £10,949, as compared with £29,242 in the previous balance sheet, the £19,000 having been written off for depreciation. There appeared a loan of £7,000 to the Corporation of Chelmsford in connection with its housing scheme. This was part of a total sum of £10,000, the loan being repayable at six months' notice. Turning to the other side of the balance sheet they would see that the capital remained practically the same as last year; the balance of the new capital was received in March, 1920, and therefore came into the last accounts. Sundry creditors also showed a substantial increase, but this item included reserve set aside against taxation. The actual profit earned on trading during the year was extremely good, but, as he had already remarked, there had been a great fall in the cost of raw material, and from the profits the stocks had to be written down to a safe figure. There had been a considerable expansion of the foreign and colonial trade, which was most encouraging; but the fall in value of the rupee had considerably depleted the profits of the Calcutta business. As usual the profits were shown with taxation (corporation tax, E.P.D., and income tax) deducted. Excess profits duty came to an end with the completion of the last financial year, and this was a matter of congratulation. To show how heavily taxed the company was, out of every £1,000 earned over and above the standard the Government took £734, and left them with £266. E.P.D. was at the rate of 60 per cent., as against 45 per cent. last year. It was, therefore, with much satisfaction that the directors were able to show a net profit of £66,292,

against £52,878 last year. There was some £84,468 to deal with, or £79,601 if they deducted the interim preference dividend. Of this it was proposed to place £19,500 to general reserve, bringing up the total to £75,000, and to pay a dividend of 6½ per cent. on the preference shares, making 10 per cent. for the year, and a dividend of 10 per cent. on the ordinary shares, carrying forward £18,370. Shareholders might be interested in some further figures which gave an idea of the total taxation in various forms and total dividends in the last three years. Wages, &c., were three-quarters of a million in round figures, taxation was £150,00, while, in the same three years, dividends totalled £66,000—less than 10 per cent. of the wages and salaries, and a little more than a third of the taxation. In view of this the shareholders could hardly be described as "bloated capitalists." Last year at that time they had been in the fortunate position of being able to turn away business. To-day things had entirely altered. It was true that at the end of the year they finished with a considerable amount of work in hand, but in the present condition of trade business was extremely difficult to get. There were plenty of inquiries, but few orders were being placed. However, the settlement of the coal strike, and more recently, the engineers' difficulty, should make matters more easy. If there was a revival of trade, the company was ready to take full advantage of it.

The resolution was seconded by Mr. O. F. Tufnel, and carried unanimously.

**Anglo-Portuguese Telephone Co., Ltd.**

In their report for 1920, just issued, the directors mention that the interim dividend of 3 per cent., less tax, paid last November, absorbed £7,778, which is £213 in excess of the amount now available. The final result, as shown by the accounts, does not admit of the payment of any further dividend. The fall in exchange, combined with the ever-increasing value of imported material, high Customs duties, and sterling salaries was disastrous in its effects on what would otherwise have been a profitable year.

**French Companies.**

*The Forges et Aciéries Electriques Paul Girod* report net profits of 371,000 fr. for 1920. At the recent meeting it was decided to draw upon the reserve funds in order to reduce the debit balance of 15,430,000 fr. to 2,500,000 fr.

The directors of the *Société des Constructions Electriques et Mécaniques de Suresnes* report a loss of 3,339,000 fr. for 1920, which is attributed to the transition from war to peace manufactures and the consequent reorganisation of operations, supplies, and equipment.

*The Compagnie du Chemin de Fer Metropolitain de Paris* has declared a dividend at the rate of 4 per cent. out of net profits of 3,932,000 fr. in 1920 Under the new agreement with the City of Paris the concessions for all the lines will expire at the end of 1955, and the expropriation of the company in any case cannot take place before January 1st, 1931.

*The Compagnie du Nord-Sud*, which has declared a dividend at the rate of 4 per cent. for 1920 out of net profits of 3,560,000 fr., has entered into a new agreement with the City of Paris similar to that concluded between the latter and the Metropolitan Railway Co. The right of purchase also cannot be exercised by the City before January 1st, 1931, and the final expiration of the concession has been fixed for December 31st, 1955.

*The Société des Constructions Electriques de France* reports that the directors had leased from the Etablissements Singrun the Golbey-les-Epinal works, thus permitting of an increase in the capacity of the turbine department without awaiting the completion of the works at Tarbes. The acquisition had rendered possible the starting of the construction of ten hydro-electric sets of 10,000 h.p. for the stations being erected by the Southern Railway Co. for the electrification of its system. In addition the company had obtained control over the Compagnie Générale de Téléphonie et d'Electricité, which produces apparatus according to the Berliner patents. During the year the works at Lyons-Venissieux was extended so as to be able to construct rolling stock and electrical plant as from July, 1921. The credit balance of 76,000 fr. for 1920 has been carried forward.

The report of the *Société des Ateliers de Constructions Electriques du Nord et de l'Est*, of Paris, for last year shows a profit of only 4,619,912 fr., as compared with 5,878,424 fr. in the preceding twelve months.

**German Companies.**

The accounts of *Siemens Elektrische Betriebe*, of Berlin, indicate profits of 5,866,000 marks from electricity works and participations in 1920. After providing for normal depreciation and placing 3,531,000 marks to reserve for equalisation of exchange there remains a slight balance to be carried forward; no dividend was paid for 1919.

*The Kontinentale Gesellschaft fur Elektrische Unternehmungen*, of Nuremberg, reports net profits of 1,759,000 marks for 1920, as contrasted with 1,084,000 marks in the previous year. The directors recommend a dividend at the rate of 5 per cent. on the preference shares, which comprise practically all the share capital, as against 3 per cent. in 1919.

The directors of the *Hochfrequenz Maschinen A.G., fur Drahtlose Telegraphie*, of Berlin, reporting on the year 1920, state that it was uncertain what amount the company would receive for its 44,000 Marconi shares which were seized in London and sold. They recommend a dividend and bonus of 35 per cent. on the A shares for 1,600,000 marks and 92.8 per cent. on the B shares for 500,000 marks. It is proposed to increase the share capital by the issue of new A shares for 1,400,000 marks.

The report of *Brown, Boveri & Co.*, of Mannheim, states that the turnover in 1920 considerably increased, as compared with the preceding year. The output of large machines had not yet again reached the pre-war level, although greater activity was being displayed, and a separate factory had been acquired for the construction of large rectifiers. As net profits the accounts show the sum of 5,961,000 marks, as against 834,000 marks, and a dividend at the rate of 10 per cent. has been declared on share capital of 40,000,000 marks, (as contrasted with 6 per cent. on 9,000,000 marks in 1919. The share capital is now to be raised to 80,000,000 marks.

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**Monterey Railway, Light & Power Co.**—According to the *Financial News*, the affairs of this company have now reached a position which enables the company to submit a scheme of reorganisation, and the 5 per cent. first mortgage debenture stockholders' protective committee strongly recommends that this scheme should be accepted. The scheme entails the funding of the arrears of interest due to the 5 per cent. first mortgage debenture stock holders and to the Canadian Bank of Commerce, and the surrender by the 5 per cent. first mortgage debenture stock holders of one-sixth of their nominal capital; but, as a set-off for the above, they obtain securities payable at their option in Canada in dollars or in London in sterling, a provision which it is hoped will create a market for the new securities in Canada, and consequently, an enhanced value on the London Stock Exchange. Further, the new securities will have sinking funds, which there was no obligation to provide for the present 5 per cent. debenture stock.

**Stock Exchange Notices.**—Dealings in the following securities have been specially allowed by the Committee under Rule 148a :—

Ever Ready Co. (Great Britain).—12,000 ordinary shares of £1 each, fully paid, Nos. 230,001 to 242,000; 3,636 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 130,008 to 133,643.

Puebla Tramway, Light & Power Co.—$1,317,500 prior lien 5 per cent. 50-year gold bonds, Nos. A1,001 to A1,855 ($100) and C501 to C1,732 ($1,000).

**Pernambuco Tramways & Power Co.**—The accounts for 1920 show a profit, including balance brought forward, &c., of £109,567. After utilising £51,149 for debenture interest, £10,230 to capital reserve, £6,800 to interest on 8 per cent. notes, £4,177 interest, discounts, &c., and £7,338 for exchange, there remains available £29,873, out of which the directors have placed £10,000 to renewals and general reserve and £1,500 to amortisation account, leaving £18,373 to be carried forward.

**Canadian General Electric Co.**—With reference to the dividend of 20 per cent. announced in our issue of July 8th, we gather from the financial Press that resolutions have been passed by the company that out of the accumulated surplus of the company arising from the appreciated value of capital assets, as appearing on re-appraisal, there be capitalised the amount of $1,800,000 and that fully-paid common stock be issued to the respective holders of common shares to the amount of 20 per cent. of their holdings by way of stock dividend.

**New Issues.**—*Shropshire, Worcestershire & Staffordshire Electric Power Co.* — An issue was advertised yesterday of £300,000 7½ per cent. ten-year convertible stock at 97; it was be guaranteed by the B.E.T. Co.

*Calcutta Electric Supply Corporation, Ltd.*—250,000 ordinary shares are to be offered to shareholders at par.

**Lima Light, Power & Tramways Co.**—The profit for 1920 totalled £P263,710, less bond service £P51,124, bond amortisation £P49,320, European expenses £P1,571, interest and discounts £P15,345, provision for bad and doubtful debts £P3,000, leaving £P143,347, plus brought forward £P95,091, making £P238,438, of which dividends on share capital absorbed £P113,546, to cost of stores £P15,000, to cost of extraordinary repairs £P5,200, to reserve for bad and doubtful debts £P9,600, leaving £P95,091, which the board proposes to carry forward.—*Financial Times.*

**Cape Town Consolidated Tramways & Land Co., Ltd.**—Last week, Mr. Justice P. O. Lawrence had before him a petition by this company asking the Court to sanction a scheme of arrangement with its debenture holders and to confirm special resolutions for a reduction of its capital. His lordship made the orders asked for.

**Yorkshire (Woollen District) Electric Tramways, Ltd.**—After putting £8,000 to reserve, a dividend of 6 per cent. for the year is to be paid on the ordinary shares and £9,356 is to be carried forward.

**Para Electric Railways & Lighting Co., Ltd.**—It is stated that owing to the uncertainty in Brazil on account of the low exchange, the directors have decided not to make any interim dividend payment on the preference or ordinary shares until the results of the year are known.

**Clontarf & Hill of Howth Tramroad Co., Ltd.**—Interim dividend of 3s. per share.

**Simms Motor Units, Ltd.**—The directors recommend a dividend at the rate of 7½ per cent. per annum, carrying forward £10,689 (subject to E.P.D. and corporation tax).

**Bournemouth & Poole Electricity Supply Co., Ltd.**—Interim dividend on the ordinary shares for the half-year ended June 30 at the rate of 5 per cent. per annum, less tax.

**Greenwood & Batley, Ltd.**—Final dividend of 2½ per cent. on the ordinary shares, making 5 per cent. for the year, and 3½ per cent. on the preferred, making 7 per cent.

## STOCKS AND SHARES.

TUESDAY EVENING.

UNTIL the Bank Rate is reduced to 5½ or 5 per cent. the Stock Exchange markets will continue to hope, Thursday by Thursday, for the Rate to be lowered, and thus bring into market-channels some of the £1,700,000,000 deposits which rest at present in the banks. In advance of the reduction, investment securities continue to show strength, except in the cases of a few British Government issues, which are suffering by reason of the competition introduced by the new 5½% Treasury Bonds offered at 97. So far as can be seen at present, the latter investment is not being taken up with any marked degree of enthusiasm, and this fact is considered sufficient to render it highly probable that the Bank Rate will be lowered in order to give the Treasury Bonds a fresh impetus. It is seldom that the Bank Rate falls at this season of the year; though, with times so much out of joint as they are at present, the prevailing sentiment is that "anything might happen."

While the Treasury Bonds remain on tap, as they are likely to do for some indefinite period, it is understood that a kind of tacit agreement has been reached that there shall be no fresh issues of large amount offered to the investor. How far this can be expected to operate in the case of industrial undertakings, it is difficult to estimate. In point of fact, several new issues are said to be almost ready for public subscription, issues that may make their appearance before the August Bank Holiday ushers in the month of school holidays, with its consequent paternal disinclination to bother about Stock Exchange securities. Meanwhile, quotations for the recently issued Debentures are well maintained. The General Electric Company's 7 per cent. Debenture stock, which came out at 92½, and dipped to 4 discount on the underwriters being left with over 40 per cent. of their obligations, rose on Monday in this week to a small premium. Apparently this invited selling, because the price went back to its "par" level, at which it still looks cheap, considering the character of the security.

The North Metropolitan Electric 7½ per cent. Debenture, which came out at 95, keeps firm at 4 premium, and Metropolitan Electric 7½ per cent. Extension Debenture, after being 6½ premium, eased off to 6 premium. Melbourne Harbour Trust 6½ per cent. Debentures, issued at 98, now stand at 1 premium. City of London Electric 8 per cent. Preference, after touching 22s. 6d., shed a few pence, while the new Ordinary remain steady at 23s. There is a ready market for nearly all the newly-issued stocks and shares of good class, and money goes steadily into these investments. Concurrently, demand has arisen for the Debenture and Preference stocks of the Home Railway Companies, including those of the Underground group. After being difficult to sell for four or five weeks past, these stocks have come into fresh favour, with the result that practically every day a dozen stocks add to their quotations.

Rumours of an impending issue by the Underground Electric Railways of London brought about a sharp fall in the prices of the company's £10 shares, and of the shilling shares, to 2⅜ and 6s. 6d. respectively. The Income Bonds were not greatly affected. Up to the present, neither confirmation nor denial has been obtainable, but that fresh money will have to be provided sooner or later would surprise nobody who travels on the line, and observes the frequent advertisements drawing attention to the sums that are being spent upon fresh rolling stock, &c. The conclusion of the coal strike is helping Home Railways, other than the Undergrounds, to an appreciable extent, although the average investor still declines to take any active interest in the Ordinary stocks of the Home Railway industry at a time when it is about to be handed over to private control, after seven years' operation by the Government. The reports of the Underground companies are expected to be out on the Thursday evening in this week, when probably some intimation will be given as to what new capital proposals may be regarded as necessary.

Charing Cross Ordinary at 3½ are the fraction better, and there are small rises, also, in Metropolitan Preference and South Metropolitan Preference. The electricity supply market is good as a whole, and there are very few shares on offer. The new Calcutta shares are quoted at 3d.—6d. premium. Probably the Shropshire, Worcestershire and Staffordshire Electric 7½ per cent. 10-year Debentures, to be offered at 97, will be out before the end of the week. The issue is guaranteed by the British Electric Traction Company. Lancashire Power First Preference at 16s. 6d. are sixpence lower.

In the cable group, Anglo-American deferred stands out with a rise of 5s. at 16½, while the Eastern issues are all steady, with Globe Ordinary 5s. better on the week. United River Plate Telephones have improved to 5⅞, and there is decided improvement in the Bonds and stock of the various Canadian and American companies upon which the interest is payable in dollars. Shawinigan Common hardened to 122½. Rio Firsts are better at 91½, and a number of other rises are recorded as the result of the way in which the value of the dollar continues to advance. The price of Canadian General Electric at 103 is ex about 25 for the value of the stock-dividend deducted this week.

iSemens Ordinary and Preference are both better at 23s. 3d. British Aluminium stiffened to 16s. 3d. General Electric Ordinary fell back to 20s. 6d., but recovered to 21s. 10½d. English Electric 8 per cent. Notes are ½ higher at 93¾. The market in manufacturing shares is generally firm. A better tendency developed in the rubber list, in consequence of the expectation that the measures now being taken by the Rubber Growers' Association for drastic curtailment of the output of the material, will have the desired effect. The best prices, however, were not maintained. Armament and engineering shares are inclined to be a little easier, with Vickers offered at 13s. The foreign traction group shows no particular changes other than further improvements in the stocks of the British Columbia Electric Railway. Para Electric Railways and Lighting Ordinary and Preference are somewhat nominal at 5s. and 7s. 6d. respectively, on the directors' decision not to pay any interim dividend on either. This is dictated by the uncertainty in Brazil on account of the low exchange; the question of the dividend-payments is to be postponed until the results of the year's working are known.

### SHARE LIST OF ELECTRICAL COMPANIES.

| | Dividend 1919. | Dividend 1920. | Price July 19, 1921. | Rise or fall. | Yield. £ s. d. |
|---|---|---|---|---|---|
| **HOME ELECTRICITY COMPANIES.** | | | | | |
| Brompton Ordinary | 12 | 12 | 8 | — | £10 0 0 |
| Charing Cross Ordinary | 7 | 8 | 8¼ | — | 10 6 6 |
| do. do. do. 4½ Pref. | 4½ | 4½ | 8⅜ | + ⅛ | 7 4 8 |
| Chelsea | 4 | 6 | 8¾ | — | 9 4 8 |
| City of London | 13 | 14 | 13 | — | 11 4 8 |
| do. do. 6 per cent. Pref. | 6 | 6 | 17½ | — | 7 1 2 |
| County of London | 8 | 8 | 8¼ | — | 9 17 6 |
| do. do. 6 per cent. Pref. | 6 | 6 | 8¼ | — | 7 7 6 |
| Kensington Ordinary | 7 | 9 | 4¼ | — | 10 18 9 |
| London Electric | 2½ | 2½ | 1 | — | 7 10 0 |
| do. do. 6 per cent. Pref. | 6 | 6 | 8¾ | — | 10 18 9 |
| Metropolitan | 6 | 7 | 8¾ | — | 9 18 6 |
| do. 4½ per cent. Pref. | 4½ | 4½ | 6¾ | + ⅛ | 7 16 6 |
| St. James' and Pall Mall | 12 | 12 | 8 | — | 10 0 0 |
| South London | 6 | 7 | 8¼ | + ¼ | 10 13 4 |
| South Metropolitan Pref. | 7 | 7 | 16⅜ | + ⅛ | 8 12 4 |
| Westminster Ordinary | 10 | 10 | 8¾ | + ¼ | 9 6 0 |
| **TELEGRAPHS AND TELEPHONES.** | | | | | |
| Anglo-Am. Tel. Pref. | 6 | 6 | 89xd | — | 7 2 9 |
| do. Def. | 1½ | 1½ | 19⅞ | + ½ | 8 10 0 |
| Chile Telephone | 6 | 6 | 4½ | — | 6 13 0 |
| Cuba Sub. Ord. | 7 | 7 | 7⅝ | — | 9 6 8 |
| Eastern Extension | 10 | 10 | 16½xd | — | 8 8 0 |
| Eastern Tel. Ord. | 10 | 10 | 16¾xd | — | 8 8 0 |
| Globe Tel. and T. Ord. | 10 | 10 | 11⅝ | — ⅜ + ½ | 8 0 4 |
| do. do. Pref. | 6 | 6 | 9¼xd | — | 8 11 8 |
| Great Northern Tel. | 22 | 24 | 244xd | — | 9 16 0 |
| Indo-European | 10 | 10 | 20 | — | 8 6 8 |
| Marconi | 25 | — | 2⅞ | — | — |
| Oriental Telephone Ord. | 12 | 12 | 2 | — | *5 16 3 |
| United R. Plate Tel. | 5 | 5 | 5⅞ | + ⅛ | *6 10 2 |
| West India and Panama | Nil | Nil | 6⅜ | — | Nil. |
| Western Telegraph | 10 | 10 | 16½ | — | *6 1 3 |
| **HOME RAILS.** | | | | | |
| Central London Ord. Assented | 4 | 4 | 49½ | — | 8 1 8 |
| Metropolitan | 14 | 14 | 26½ | +1½ | 5 18 2 |
| do. District | Nil | Nil | 17 | — | Nil |
| Underground Electric Ordinary | Nil | Nil | 9⅞ | — ½ | Nil |
| do. do. "A" | Nil | Nil | 6⅜ | 6d. | Nil |
| do. do. Income | 4 | 9 | 82½ | —1 | 2 8 6 |
| **FOREIGN TRAMS, &c.** | | | | | |
| Anglo-Arg. Trams, First Pref. | 8¼ | 12½ | 22xd | — | 10 0 0 |
| do. do. 2nd Pref. | Nil | 5½ | 9⅞ | — | 9 11 4 |
| do. do. 5% Deb. | 5 | 5 | 64½ | —1 | 7 15 0 |
| Brazil Tractions | Nil | Nil | 31 | — | Nil |
| British Columbia Elec. Ry. Pfce. | 5 | 5 | 58xd | +2 | 8 12 4 |
| do. do. Preferred | 5 | 4⅞ | 57 | +2 | *8 8 8 |
| do. do. Deferred | 3 | 6 | 57½ | —2 | *10 16 2 |
| do. do. Deb. | 4½ | 4½ | 59½ | — | 7 2 10 |
| Mexico Trams 5 per cent. Bonds | Nil | Nil | 53½ | — | Nil |
| do. 6 per cent. Bonds | Nil | Nil | 28½ | — | Nil |
| Mexican Light Common | Nil | Nil | 11¼ | — | Nil |
| do. Pref. | Nil | Nil | 18¼ | — | Nil |
| do. 1st Bonds | Nil | Nil | 72½ | — | Nil |
| **MANUFACTURING COMPANIES.** | | | | | |
| Babcock & Wilcox | 15 | 16 | 92 | — | 8 14 6 |
| British Aluminium Ord. | 10 | 10 | 16/3 | +6d. | 12 6 2 |
| British Insulated Ord. | 15 | — | 1½xd | — | 9 19 0 |
| Callenders | 15 | 15 | 1⅞ | — | 10 8 8 |
| " 6½ Pref. | 6½ | 6½ | 17/6 | — | 7 8 7 |
| Crompton Ord. | 10 | 10 | 18/9 | — | 12 6 |
| Edison-Swan | 10 | — | 10/6 | — | — |
| do. do. 5 per cent. Deb. | 5 | 5 | 68xd | — | 7 7 1 |
| Electric Construction | 10 | 10 | 16/9 | — | 12 6 2 |
| English Electric | 8 | 8 | 12/6 | — | 12 16 6 |
| Do. Pref. | 6 | 6 | 18/- | — | 8 0 0 |
| Gen. Elec. Pref. | 6½ | 6½ | 16/6 | +6d. | 7 17 0 |
| do. Ord. | 10 | 10 | 1⅝ | — 1/32 | *9 3 0 |
| Henley | 15 | 15 | 1⅞ | — | 10 8 0 |
| do. 4½ Pref. | 4½ | 4½ | 8½ | — | 6 18 |
| India-Rubber | 10 | — | ⅞ | — | — |
| Met.-Vickers Pref. | 8 | 8 | 11/- | — | 8 16 |
| Siemens Ord. | 16 | 16 | 23/3 | +9d. | *6 19 |
| Telegraph Con. | 20 | 20 | 20½ | — | *5 17 |

* Dividends paid free of Income Tax.

# THE ENGINEERING CONFERENCE, 1921.

(*Continued from page 99.*)

## Battery Locomotives.

BY JAMES DALZIEL. (*Abstract.*)

ELECTRIC shunting locomotives may be either operated from overhead wires or from a self-contained battery. Certain limitations imposed by the battery roughly define the respective spheres. Generally speaking, for yards where the work is moderate and fairly uniform, especially where fairly long lengths of infrequently worked siding are involved, battery locomotives will economically replace horse or capstan shunting. A probable field for battery traction on electrified main lines is that of working wayside sidings with a battery tender to supply the main-line locomotive. Some branch lines may be worked economically with battery locomotives. Shunting in large goods yards will probably be best effected by locomotives combining overhead conductor with battery supply, the battery dealing with the lightly worked sidings. Where the obstruction of an overhead wire is objectionable, as on quay sides, battery operation is the only form of electric traction possible.

Supply by battery alters for the worse the operating characteristics of an electric locomotive, especially as regards overload capacity. Straight battery working is not suitable for heavily worked slidings, or those out of which an occasional heavy lift has to be made, and the same applies to lines having heavy gradients, or which at certain hours require specially heavy trains to be handled. In such cases overhead conductors should be used; undue increase in battery capacity and weight, or the provision of special types, prohibitively enhances costs. Mid-day boosting charges are adverse to the life of all batteries of whatever type.

Many existing sidings where locomotive operation may be contemplated are equipped with turntables. If it is, as it may be, impossible to substitute points for these, a capstan may be fitted to the locomotive, so as to enable it to pass over such turntables and into the sidings they serve.

A typical battery locomotive was built by the Midland Railway in 1913 to supersede horse shunting in a London coal yard; its dimensions are as follows:—

Weight, 17 tons 7 cwt.; draw-bar pull, 6,400 lb., max.; normal load, 8 wagons (90 tons); maximum load, 12 wagons; speed, 7 m.p.h.; unloaded speed, about 12 m.p.h.; yard capacity, about 100 wagons; average weight per haul, about 30 tons; average length of haul, about 50 yards; annual ton miles, about 45,000 (excluding locomotive weight).

Regarding design and construction, standard wagon parts can in general be used. Hand brakes are sufficient. Special attention is required to be given to battery box ventilation and insulation. Motors should be wound specially for low speed and single reduction gear. The Midland locomotive motors are of 22 h.p. at 220 r.p.m., nose-suspended and spur geared 15-68. A single controller is fitted in the driver's cab of ordinary tramway type with rheostat braking.

Special batteries of the road vehicle type are unnecessary for rail traction; a flat plate type battery is sufficiently good for the service, and it is anticipated that battery contractors will guarantee such batteries for up to ten years at an annual charge of 10 or 15 per cent. of their first cost. On the Midland engine the battery is by the D.P. Battery Co., consisting of 108 train-lighting type cells in wooden lead-lined boxes, the capacity being 300 ampere-hours at the ten-hour rate.

Charging arrangements should be sufficiently automatic to enable technically unskilled labour to be normally employed. In the Midland case charging is done from the Corporation mains through a motor generator; the generator is wound with shunt and reverse series coils, so that the maximum voltage that can be impressed on the battery is about 2.6 per cell with 10 amperes only passing, while with 70 amperes passing the voltage becomes only 2.1 volts per cell. The shunt coils can be adjusted by field regulation, so as to bring up the voltage to 2.7 per cell for gassing charges, which are given periodically under skilled technical supervision.

In a self-contained yard such engines can be driven by the yard staff, who can also perform other duties. If the engine has to work on to or across the main line a qualified driver would have to be employed. The energy consumption of battery locomotives is necessarily high. In addition to the normal losses by frequent stops and braking, there are the special losses in the battery and charging plant. In the Midland case the energy consumption measured at the Corporation meter averages about 100 watt-hours per ton-mile. The overall efficiency is about 50 per cent., *i.e.*, a battery locomotive consumes about double the energy of a conductor-supplied locomotive on the same work. On the other hand, rail bonding in yards presents some difficulties; moreover, in most cases an earthed return is not permissible; motor generator losses are thus inevitable unless double overhead wires are used.

A locomotive of the type and capacity described would cost (pre-war) approximately £900 with, say, about £200 in addition for charging plant. This locomotive replaced five horses and four men (pre-war), the annual value of which, at to-day's prices, is about £1,600. The working cost of the locomotive for the year 1920 was about £400; adding provision for battery renewal, interest, and depreciation at to-day's prices and rates, the total cost amounts to about £800, so that in similar conditions such an engine could be installed to-day to save £800 per annum over horse shunting.

### DISCUSSION.

Mr. J. Dalziel's paper was read and discussed on the third and last day of the Conference, when Mr. C. P. Sparks presided over Section VII.

Sir H. FOWLER opened the discussion by explaining that one advantage of the type of engine under review was that it could go anywhere that a truck could go. On the Midland Railway they had only experienced one accident in ten years, and he was of the opinion that battery locomotives would prove very useful on the small branch lines, of which there were many in this country over which there was very light traffic, and which it would not be advisable to electrify in the usual way.

Mr. C. H. MERZ said that a good deal could be done by battery locomotives at a small expenditure. More trials of the kind mentioned by the author would be very beneficial, as the subject had not received enough attention, and it was only by such trials that the exact battery capacity, the best charging conditions, plate improvements, and other data could be determined.

Mr. R. T. SMITH wanted to know whether difficulty was experienced from the spilling of acid when the open battery was used, and whether any precautions were taken as in the case of train-lighting batteries? The shunting of mineral trains by horse haulage had cost £3,000 per annum, but by replacing the horses by "Clyde" electric capstans that figure had been reduced by half. Moreover, a horse could only haul one truck at a time, whereas a capstan could handle a whole train of 200 tons. Capstans could be operated by the ordinary yard staff, and the cost of electricity came to between £20 and £40 per annum. If a qualified driver was provided for a battery locomotive, £200 must be added to the annual cost, and whether such locomotives would displace capstans depended entirely on whether they could be operated by the yard staff or not. He agreed about the usefulness of battery engines on branch lines, and complimented the author on his use of ordinary wagon parts for building the locomotive. That reduced the capital cost to at least half what it would have been had a special design been employed, and he recommended other engineers to copy the author's practice.

Mr. F. LYDALL thought that the author's locomotive had given a very good performance, but it was too small to be of much use in main-line goods yards. An average of 103 tests in 66 American yards showed an average length of run of 628 ft., an average time of run of 79.5 secs.; an average time of stop of 53 secs., an average speed in motion of 5.4 m.p.h., and an average speed, including stops, of 3.24 m.p.h. with an average load of 306 short tons. However, that service was probably well above what would be required in small English yards. For dealing with full trains of from 600 to 700 tons the battery would have to be very large, unless it could be recharged at very frequent short intervals. The author's remarks about boosting were not strictly correct; was it practicable to intermittently charge an accumulator from an overhead conductor or third rail?

A speaker, on behalf of the battery makers, pointed out that battery locomotives were being used in shipyards, coal mines, &c. If a boost was necessary (up to the full charge) it did no harm whatever to the battery. The use of flat plates might make the height of the latter too great. He only knew of one explosion in 100 locomotives.

Sir P. DAWSON asked for more information, as the subject was one of much importance.

Mr. ELLIOTT explained that heavy batteries would last between seven and eight years, whereas the life of the lighter types was only two or three years.

Mr. P. EDWARDS expressed the opinion that if railway electrification developed in this country battery engines would have to be built very much larger and heavier than they had been so far, and suggested that regenerative braking might be adopted as a means of charging the accumulators.

Lieut.-Col. F. A. CORTEZ LEIGH was not in agreement with the author as regarded the use of battery locomotives on branch lines and sidings: the equipment of such lines was not expensive and, therefore, it would be more efficient to equip them in the ordinary way. He emphasised the importance of control, and suggested that Edison or Exide batteries would be more suitable than the Planté type, on account of the rough handling shunting engines received in the goods yards. The type of battery used for platform trucks (which vehicles worked very satisfactorily, and were exceedingly robust) would be suitable for locomotives. He endorsed what Mr. R. T. Smith had said about capstans, and pointed out that labour conditions necessitated two men being allocated to each electric locomotive. Did drivers insist upon being placed on the same footing as drivers of steam engines? Before the war he had seen in Hungary petrol-electric engines working economically and well, and he thought there was an opening on English branch lines for such locomotives in place of the battery type. They must have large experience, and

it was foolish to condemn a certain type because one or two samples did not work well. He was of the opinion that there was a very large field in this country for electric shunting in busy yards; considerable money would be saved by electrification, and there was plenty of opportunity for locomotive designers.

Mr. A. C. AGNEW drew attention to the disappointing results that were often obtained with battery locomotives from the point of view of speed. The Edison battery was very durable, but its energy efficiency was low compared with the lead type. Mid-day or boosting charges could not do any harm, and the author was sanguine if he expected makers to guarantee their batteries at 10 per cent. per annum. All drivers expected to be dealt with on the same level.

Mr. F. W. CARTER suggested that battery locomotive motors should be compound instead of series wound, so as to enable them to regenerate, and to increase the radius of the engine. That would increase the switching arrangements, but patent No. 16,997 of 1908 showed that something in that respect had been done in the case of road vehicles.

Mr. BROUFFELL was of the opinion that for yard work the engine must be light, and it was no good attempting to handle 200-ton trains. A main-line locomotive would probably weigh 100 tons; a battery tender would double its weight so that the speed would be very low; they must do the work cheaper and quicker. The efficiency of the present battery locomotive was too low, but there were two ways of improving it: To alter the control and do away with some of the rheostatic losses, and to turn the waste energy from the brakes into the battery.

The CHAIRMAN (Mr. C. P. Sparks) thought they were in the hands of the battery makers, and that a special battery (not the lead type) was needed for such service.

Mr. J. DALZIEL, in reply, said that battery explosions could be prevented by adequately ventilating them, and he had experienced no trouble from the spilling of acid. Edison batteries were liable to explode at any time, although they were not harmed at all thereby. The weight of a battery was really an advantage, because the difficulty was not in starting but in stopping a train; the battery tender could be carried behind in place of the brake van. Battery traction was no good for heavy work, and the advantage of a battery engine over capstans was in the capital cost. He estimated the cost of ten capstans at £6,000, and if the choice was left to the track department, the battery locomotive would be preferred every time. They had had no trouble with the staff at all.

(*To be continued.*)

## THE THERMAL EFFICIENCY OF HEAT POWER PLANT.

(*Continued from page* 100.)

A discussion on "Air Heating for Boiler Furnaces" was opened by Mr. W. H. PATCHELL, vice-president, who pointed out that 80 years ago air heating was practised. In the mercantile marine it was very largely used in connection with the forced-draught system of Messrs. James Howden & Co., of Glasgow; that the heater was commercially efficient was beyond question. The application of the Ellis & Eaves system of air heaters and induced draught to boilers installed by Messrs. John Brown & Co. at Sheffield Electricity Works enabled them to burn soft Yorkshire coal without the production of smoke, which without the hot air supply was copious. Detailed tests of boilers with and without air heaters were hard to get; such figures as were available had been analysed, and the results were given in tabular form. Tests on a Belleville boiler fitted with a superheater, fan, and air heater showed the following results:—

| | Efficiency. | $CO_2$ | Excess air. |
|---|---|---|---|
| With the air heater ..... | 69.2 % ..... | 10.0 ..... | 89 % |
| Without the air heater ..... | 60.2 % ..... | 7.87 ..... | 140 % |

The excess of air had been calculated from Bunte's formula, 18.9/% $CO_2$, and was therefore only approximate.

The following data are extracted from the table above-mentioned:—

AIR HEATERS.

| Year. | | Type of boiler. | Type of stoker. | Type of air heater. | Temp. of gases leaving boiler. ° Fah. | Temp. of air entering furnace. ° Fah. | Rise in temp. of air. ° Fah. | Excess of air over that necessary. % | Extra efficiency of boiler due to air heater. % | Efficiency of boiler and air heater (including superheater). % | Efficiency of air heater. % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1914 | ... | Stirling | Underfeed, travelling | Usco | 526 | 197 | 199 | 28 | 3·1 | 85·3 | 79 |
| ,, | ... | ,, | ,, ,, | ,, | 564 | 202 | 131 | 61 | 4·0 | 83·6 | 69 |
| 1913 | ... | ,, | ,, ,, | ,, | 588 | 247 | 155 | 47 | 4·2 | 83·3 | 71 |
| 1912 | ... | Woodeson | Class E, Underfeed | ,, | 591 | 230 | 153 | 36 | 3·9 | 80·5 | 76 |
| ,, | ... | ,, | ,, ,, | ,, | 648 | 272 | 184 | 54 | 5·3 | 79·5 | — |

The calculated "extra efficiency" did not take into account any gain from improved combustion or anything but the thermal units returned to the furnace with the air. There were no figures available showing the moisture in the air supply—an important point. It was noteworthy that when the air supply was cut down to the minimum required for the best boiler efficiency, the extra efficiency due to the air heater was lower than when, as in ordinary boiler practice, a large excess of air was admitted. With regard to the effect of hot air on the grate or stoker, stokers of the retort type, where the grates were more heavily covered, could be safely operated with a hotter air supply than stokers of the chain or travelling grate type, where the fuel bed was thin. The hot air could be supplied above the grates. The characteristics of the fuel required very careful consideration, with regard to the ash, clinker, &c. The effect of the hot air would be to raise the temperature of the furnace, and in the case of large boilers there might be more anxiety regarding the maintenance of the refractories than of the boiler proper.

The ordinary form of Howden heater had straight steel tubes fixed in steel plate casings. The "Usco" and the "Thermix" were of the leaf or diaphragm plate type.

The removal of dust from air heaters would require as much consideration as the cleaning of the boiler tubes.

Steel uptakes and chimneys had been largely used, and where condensation did not take place the maintenance had been light. Mr. Patchell hoped that better records of tests would be forthcoming; the extra efficiency of the boiler as shown by arithmetical analysis was certainly not enough to encourage the purchase of air heaters, but it was a fact that air-heaters had given great satisfaction, and there was an over-all commercial advantage in using them.

Supplementing the paper, Mr. PATCHELL said that a big combustion chamber and high tube clearances were necessary, as had been shown by himself and Mr. Miller years ago, but the boilermakers would not then follow their lead.

In a written communication, Mr. D. WILSON commented on the lack of evidence that success had been attained with air heaters.

Mr. OWEN (Messrs. Howden & Co.) pointed out that air heating was in very extended use in the mercantile marine. Messrs. Rowans, of Glasgow, made tests over a long period, showing an economy of 15 per cent. The system had its best chance where the cost of coal was high. The combustion of the fuel was the main phenomenon, and needed the most careful attention; great quantities of air were admitted to furnaces in excess of the necessary minimum, and could be reduced by heating the air, which should have the first claim on the heat contained in the waste gases, in order to improve the conditions of combustion.

Mr. BENNIS considered it remarkable that the makers of air heaters did not themselves make thorough tests of the efficiency obtained.

Mr. S. E. FEDDEN described plant which he had installed 22 years ago, which increased the evaporation of the boilers from 11,000 to 14,000 lb. per hour. He used a steam jet to cool the fire bars. There were risks of corrosion due to cold feed water, and of injury to the furnaces by excessive temperatures; he was not convinced either way, but on the whole he preferred to be without the air heaters.

Mr. C. ERITH pointed out that at sea water economisers could not be used, so that air-heaters had a better opening. In many power stations water economisers were being dispensed with, owing to the high efficiency attained by boilers of modern type. The high cost of coal at present created a tendency to reopen the question of air heaters, but there was not much to be gained from them. Perfect combustion could be achieved nowadays with cold air.

Mr. S. UTTING said that the faint praise accorded to air-heaters reminded him of the history of the superheater; failures had taken place, but it was only a matter of improvement in design and construction. To extract the heat from the flue gases the best scheme would be that which entailed the lowest capital and running costs; with air heaters they could do this at a lower capital cost than with water economisers, but could they fully utilise the hot air? The makers of stokers set a limit on the temperature of the air. In the case of a new installation, they might cut down the cost of the water economiser and replace part of it with an air heater. Where hot air was needed for manufacturing processes, it could be heated by the flue gases. Owing to the higher steam pressures in vogue, the cast-iron tube economiser would have to go, and be replaced either with steel tubes or air heaters.

Mr. TANSLEY preferred cold air with steam jets to hot air without, and Mr. GILLESPIE referred to marine practice.

In reply, Mr. PATCHELL mentioned that in up-to-date practice in the United States, with large boilers worked economically and feedwater heated by steam, water economisers were cut out. At Chicago, using a pressure of 350 lb. per sq. in., a steel economiser was installed in series with an air heater.

# THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

## ANNUAL CONGRESS.

THE annual general meeting and Congress was held at Caxton Hall, Westminster, London, on Friday, July 15th.

Mr. C. G. TEGETMEIER presided at the annual general meeting and formally proposed the adoption of the Council's report and accounts for the past year. In doing so, he gave a short review of the work of the Council during that period. The total revenue for the year amounted to £799 and the expenditure to £774. The balance of £25 increased the assets of the Association to £670. The work done during the past year, he said, must be regarded in conjunction with the work of the Conference of tramway and light railway companies, which was a separate body from the Association itself, although constituted within it for dealing with matters relating to the tramway industry outside the scope of the Association as such, more particularly with regard to wages and labour questions generally. One of the important functions of the Conference was to elect representatives of the industry to sit on the National Industrial Joint Council, and the Municipal Tramways Association had now a similar organisation. Thus the municipal and tramway undertakings had representatives who met on common ground to deal with matters of common interest. During the past year, as in the preceding two years, labour and wages questions had constituted the most important matters which had had to be dealt with, and much time and work had been devoted to them by the various representatives on the National Joint Council. Mr. Tegetmeier related the difficulties which had had to be encountered, especially with regard to wages, which culminated in the trouble of last year when strikes were threatened and, indeed, in some places, actually took place. The position now was, however, that undertakings had been graded into three groups according to local conditions and financial capacity to pay certain rates of wages, and the latest settlement had been to take the best rate of wage in each district and add 3s, 2s., and 1s. per week respectively, there being a slide up or down according to the index figure for the cost of living; the rise or fall was 1s. for every 5 complete points, and the adjustment was made every three months, the index figure upon which the adjustment was to be made being 135. At the moment the index figure was 119, so that, assuming that no other change took place before the next quarterly revision, there would be a reduction of 3s. per week in wages. The large increases in wages which had been taking place had put the tramway industry in a very difficult position, and it had only been able to carry on by reason of the Temporary Increase of Charges Act of 1920, which enabled the undertakings to charge such fares as would give them a reasonable profit and a reasonable return on their capital. Such increases, however, could only be made after application to the Ministry of Transport, and already 75 undertakings had obtained orders under the Act. Others had been able to make increases in their fares under their own private Acts of Parliament. Among the other matters which had called for the attention of the Association during the year was some relief for tramway undertakings from the heavy burdens imposed upon them in respect of road maintenance, but certain amendments proposed by the Association to the Roads Bill of 1920 were not accepted by the Minister of Transport. More recently further representations had been made on the subject, but a communication had been received from the Minister of Transport to the effect that he could not see his way to promote legislation for the purpose of relieving tramway authorities from their statutory obligations under Section 28 of the Tramway Act of 1870 or to make any contribution to the cost referred to out of the Road Fund. There, unfortunately, the matter remained for the present.

The following members of Council retired:—Messrs. F. Coutts, E. H. Edwardes, H. England, A. L. C. Fell, Alderman R Mayne and Mr. W. Shearer. To fill the vacancies the following were elected:—Messrs. W. V. Edwards, R. J. Howley, — McGill (Balfour, Beatty & Co.), F. E. Gripper, J. K. Bruce, and I. Bulfin.

The annual business meeting closed with the re-election of the Hon. Auditor, Mr. A. W. Chalmers.

Two papers were then read and discussed, Alderman Smithson of Leeds being in the Chair. The first was "Tramway Track Maintenance," by Mr. R. B. Holt.

### Tramway Track Maintenance.

BY ROBT. B. HOLT, M.I.MECH.E., M.INST.C.E.I. (*Abstract.*)

THE standard of track maintenance has suffered a serious setback in consequence of the war and its aftermath of industrial unrest, high wages, shorter working hours and increased cost of materials. The standard to-day on many tracks is that of over 15 years ago. In consequence of the almost entire neglect, during the war, the whole of the improvements effected during the reconstruction period have been lost; the standard has deteriorated, and, as a natural consequence, slower speeds and uncomfortable travelling are general. As reserve funds have vanished, in most cases, and revenues do not as yet permit of an adequate amount of reconstruction, renewals are of rare occurrence, and the life of rails and pavement is being prolonged to the fullest extent by means of rail hardening, groove deepening, the building-up of hammered joints by the arc and autogenous welding processes, the reversal of paving setts, and the replacement of sett paving by monolithic surfaces of asphalt and tarred macadam.

With regard to new rails, recent experience indicates that it is essential that rails shall be rolled with deeper grooves from steel of a more durable quality than that obtained under the standard specification. In this country rail grooves about 1¼ inches deep have been adopted by the Liverpool, Hull, and Doncaster tramways. There is no disputing the fact that a deep groove is essential, and it is the duty of the Standards Committee to take cognisance of this and other requirements in order that they may direct the necessary changes, for without their supervision the elements and advantages of standardisation will be lost. One square inch of additional sectional area represents approximately a 10 per cent. increase in the total weight of the rail, and the writer suggests that this might be counterbalanced by reducing the width of the flanges. At the same time the rolling mill difficulties would be decreased. There is no reason for any paved-in British tramway rail to have a flange 7 inches wide; this could be reduced to as little as 5 inches with advantage.

The wear of rails is exceedingly variable, and comparisons are not readily made between the wear of rails on different undertakings in consequence of variations in the design and equipment of the rolling stock and the local conditions.

Gaugings obtained by means of the Sandberg Rail Wear Gauge, which has been specially designed to record accurately to within 4/1,000ths of an inch, show that the wear of the rail profile varies considerably on different systems. On many of the rails where track brakes are used there is a pronounced increase in the inclination of the tread towards the groove; whilst very little wear is taking place on the outside of the rail tread, a very considerable loss of metal takes place on the gauge side, and if this rate of wear continues the wheel flanges will soon touch the floor of the groove.

At last year's Conference of the Association Mr. Ireland, in the discussion on Mr. Pringle's paper, stated that the worn profile of the rail was brought about chiefly by the shape of the tire, and that "the area of contact had a definite bearing on the subject." He had discovered by actual experiment that "the load per square inch of contact was about 65 tons, from which it was obvious that the tire was being overloaded to such an extent that it would not keep its shape for any length of time, and that loss of metal through detrusion took place, and that it followed that whatever the shape of the rail to begin with, it was ultimately rolled to the shape of the tire." The writer agrees with Mr. Ireland in regard to the over-stressing of the metal in both the tire and the rail tread, and it is obvious, in many cases, that the elastic limit of the steel is exceeded. In view of the increase in weights and speeds of tramway cars it is up to the track engineer to safeguard his rails against the effects of the excessive compressive stresses, which are admittedly responsible for abnormal tire and rail wear which result in detrusion, battering, and, in the opinion of many authorities, in rail corrugation.

The precise cause or causes of rail corrugation have not yet been determined, but the Rail Corrugation Committee, on which members of the Association served, definitely established the fact that corrugations do not exist in the rails as received from the mills. Whatever the origin of the force may be, its culminating effect is to exert such pressure, through the wheel, on the rail tread that the elastic limit of the steel is exceeded. It is evident that consideration should be given to the manufacture of rails possessing superior wearing properties. For many years the writer has endeavoured to bring the fact home that rails of the standard composition and quality are not suitable for the work they have to perform. The tensile strength of the standard rails is approximately 45 tons per square inch, and the elastic limit is only about 20 tons per square inch, the Brinell hardness number being less than 200. Mr. Stephen Sellon recommended, as a preventative of rail corrugation, that the elastic limit of the steel should be raised to 60 tons per square inch, and in view of Mr. Ireland's statement it would appear that even this is barely sufficient, with heavy cars of the London County Council type, to resist the pressure exerted through the wheel tire and to prevent the detrusion of wheel and rail metal.

The time is apparently opportune for the Standards Association to consider the revision of the Tramrail Specification, and in doing so it is recommended that in specifying the chemical composition this should be merely a guide for the manufacturer as to the composition and limits of impurities considered to be likely to produce a material of the required mechanical properties. The specification should not insist on the composition being rigidly adhered to, provided the mechanical and special tests are fulfilled.

Many factors, such as bad conditions of casting, improper heat treatment, burning, &c., may introduce defects infinitely worse than the mere presence of a few hundredths per cent. of sulphur and phosphorus, and such defects may, without careful supervision, fail to be revealed by either the ordinary mechanical or chemical tests. The tendency is for an inflated

value to be placed on the results of chemical analysis, and most specifications overlook one of the most important mechanical properties of steel in relation to its behaviour in service, i.e., the elastic limit, and to attach undue importance to the ultimate strength, to which it bears no necessary or fixed relation. The most advisable method of obtaining a high elastic limit combined with the necessary toughness as by means of suitable heat treatment.

The superior physical and wearing properties possessed by rails treated by the Sandberg Sorbitic process, which is applied at the rolling mills, are demonstrated by the very severe operating tests which have been carried out on the Turkey Hill curve of the Pennsylvania Railroad, U.S.A., over a period of two years, and it has been ascertained that the increased life of the sorbitically treated rails was 85 per cent. During the test the actual loss of metal on the treated rails was a little over 7 lb. per yard, whilst on untreated rails the loss was over 13 lb. per yard. The effect of the sorbitic treatment is to increase the elastic limit of the steel by approximately 10 tons per square inch.

The Woods-Gilbert re-modelling process is an effective method of prolonging the life of existing rails. By this process the floor of the rail groove is milled away to the extent of about 5/16ths of an inch, thus allowing the wheel flanges to travel free of the groove for a considerable period, and clearing away the irregular ridges of extruded metal near the gauge line. The depth of the metal remaining in the groove after the milling operations should not be less than 5/16ths of an inch.

Excellent salvage work has been carried out on numerous undertakings throughout the country in the way of repairs to hammered joints by means of the electric arc and autogenous welding processes. Considerably more use is now being made of the arc welding process than in pre-war days, and from what the writer has seen it is likely to develop in popularity, as it is independent of outside sources in regard to supplies. The deposited metal should be of the same chemical composition and hardness as the rail itself. The metal in many of these repaired joints is much softer than the rail upon which it is deposited, and analyses reveal that the deposited metal is generally lower in carbon. Such metal cannot be expected to withstand the effects of a heavy high-speed car service satisfactorily for any length of time. It is essential to ensure that a sufficient amount of carbon passes through the arc or flame into the deposited metal. This can be arranged to some extent in the case of the arc welding process by regulating the length of the arc. In repair welding of this description it is well worth the additional expense to have the fishplates spot-welded to the rails as in the practice of the Rail Welding Company, London. Where the joints are not too badly battered, excellent results are being obtained by means of a single Thermit weld.

In the "Insitu" Rail Hardening Process, patented by Mr. C. P. Sandberg over four years ago, an oxy-acetylene installation mounted on a truck is propelled slowly by hand along the track, whilst the flames from specially designed burners impinge upon the tread of the rail; a small area of the tread is raised to a temperature above the critical range, and immediately behind the flames jets of water are sprayed upon the rail, thus quenching and cooling the treated portion. The treatment produces a hardening effect for a depth of about ¼ in., the outer portion to a depth of fully ¼ in. consisting of martensite, and therefore of the maximum hardness. Up to date over 100 miles of track have been treated on 23 of the most important tramways in the kingdom, and orders have been obtained for the treatment of a further 30 miles of track. On the average, the wear of the untreated rails is about 2½ times that of the treated rails.

Very considerable difficulty has been experienced during the past few years with regard to the maintenance of the track paving. Very satisfactory track pavements can be obtained from the use of both asphalt and tarred macadam, either with or without a course of setts alongside the rail. The cost of points and crossings and tramway layouts is a very serious item in these days, and engineers are building their own junctions with scarfed crossings; a much better job can be made than formerly, in consequence of the availability of the arc and autogenous welding processes. Considerable economies could be effected by the use of shorter and lighter points and crossings. The design of points and point mechanism requires considerable simplification.

Mr. Holt added that the description in the paper of the Rail Welding Company's process was not quite up to date. He understood the present practice was to entirely weld up the horizontal joints between the head and the flange of the rail and the fish plates, and not to cut out defective joints.

### Discussion.

Mr. A. Norton said that the post-war cost of maintenance had kept rails in service long after their effective life, but the Sandberg process, according to the paper, had been instrumental in getting a very much longer life out of the rails. At the same time, the operation seemed a somewhat costly one. He agreed with the author that to deepen the depth of the groove of tram rails from 1¼ in. to 1½ in. would be a good thing. With regard to special track work, it was frequently specified that the depth of the groove should not exceed 5/16 in., but the effect of that was that the tire often ran over the grooves, which wore the tire away and did not stop the bumping which took place at the special track work. It would be very much better to keep the depth of the groove at the special track work the same as the height of the tire flange, which was fixed at 9/16 in. for most sections on British tramways. If that was reduced there was a risk of the tire mounting the special track work when going at high speeds. With regard to the effect of detrusion, referred to in connection with Mr. Ireland's paper before the Association last year, with which the present author agreed, it would be interesting to know the width of the tires and also the angle of inclination as originally placed in service, because that had an important bearing on the question. Considerable importance also attached to the tires on the same axle being of equal hardness. With the tendency to increase the hardness of the tires, one would imagine that there would be a proportionate increase in the hardness of the rails. A recent American specification shewed 0.7 to 0.85 carbon, 0.2 silicon and 0.6 to 0.9 manganese, the maximum stress being 50 tons and the elongation 8 per cent. Brittleness had not the same vital effect in the case of tramways as railways, because in the former case the rails were supported over their entire length. At the same time, brittleness could be overcome by suitable heat treatment, and the greater expense thus involved was more than compensated for by the longer life. Moreover, experience had shown that a slightly higher percentage of phosphorus and sulphur than usual was not deleterious. There was a good deal yet to be learned by the steel makers in the production of perfect rails. Referring to the British Standard Specifications, Mr. Norton said that these did not always receive the publicity they deserved, but he believed that steps would be taken in future to remedy that. The tire specification had been a work of years, but it was now completed and would be published in a few days. Whilst a standard width had been adopted, the question of standardising the wheel centre was a very much more difficult matter. If users could standardise their wheel centres it would help the makers very much indeed.

Mr. W. V. Edwards (Hastings) asked for more information with regard to the regulation of the arc in rail welding. He had been welding rails by this means for some years, and although a good job could be made in building up joints of the ordinary rails, there was considerable difficulty in making a satisfactory job with manganese steel points and crossings. He had tried several different classes of electrode but had never yet found anything reliable. If they could be told the length of arc, which was an important factor, it would be interesting. Also, would the author recommend the use of manganese steel in building up special track work or even for ordinary rails.

Mr. W. Thom, speaking of narrow *versus* wider flanges for rails, said his experience was that the wide flange was the best. Many of the rails bought years ago were quite as good as the best that could be obtained now. They wanted to have the rails made in this country if possible, but if the manufacturers would not support them by giving them the right article at a proper price, there was no alternative but to go abroad.

Mr. E. B. Pickering said that some time ago the author published a book in which he urged steel rail makers to make long points for special track work, and as a result he induced his firm to take the matter up. That was done, but now he noticed the author advocated 8 ft. 6 in. points instead of 15 ft. points, and he would like to know the reason for the change. The reason originally put forward for the longer manganese steel points was that they gave very much sweeter running on the special track work. The maintenance of points was an important matter, and there could not be such satisfactory maintenance with an 8 ft. 6 in. point as with the longer point.

Mr. R. J. Howley referred to the difficulties of bringing out standard specifications, many of which took such a long time to agree upon that they were out of date by the time they were published. Most standards were a sort of compromise, owing to the conflicting views of those concerned. Quite recently, the Committee had been working on a new form of rail at the instance of Mr. Fell, but there had been great opposition to altering the existing standards for the 96 and 104-lb. rails, and these were going to remain. The new rail which was going to be called No. 8, was a heavy rail of about 114 lb. and 7 inches deep. It would have a depth of groove of 1-7/16 in. In the specification the chemical composition was set out separately for open-hearth and Bessemer rails, the open hearth having 0.6 to 0.7 carbon, which was much higher than had been used in this country. Many undertakings had been using American rails, which were higher than this, and he must say that the rails of the Lorain Steel Co. showed great resistance from the point of view of corrugation. There were objections to the use of Bessemer rails, but he believed there was a hope that we might get a harder rail in the future.

Mr. F. Bland agreed with the use of deep grooved rails. As a member of the British Engineering Standards Committee dealing with tramway rails, he regretted that a long time was taken in preparing the specifications, and he believed if the manufacturers had been left to do it, the standard specification would have been issued long ago. He imagined the author was advocating shorter points because of the cost, and it should be remembered that the cost of tramway rails did not increase *pro rata* to all other commodities of life, and there was not now a sufficient demand to cause a wholesale fall

in price. With regard to special track work, he thought there was need for simplification of the fittings.

MAJOR CALDWELL said, in connection with the arc welding process, that there was too much metal shown in the illustrations in the paper, and that better results would be obtained with a single run weld instead of what appeared to be more or less of a mould. Tests had been carried out on the Manchester system by the Woods Gilbert people, using light welds instead of the heavy welds, the advantage of the light weld being that the strength of the weld was really obtained by fusion in the first place. If fusion was not perfect in the first layer, then it did not matter how much metal was added afterwards. Such a weld on the Manchester rails withstood 56.5 tons before it broke, and then the fracture was at a distance from the weld.

Mr. C. BURNET (of the Rail Welding Co.) exhibited some samples of rails treated by his company's process, which had been in operation since 1914, and said he did not know that Manchester had any claim to have originated the type of weld which the previous speaker had referred to.

Mr. W. T. ROBSON said that not very much carbon was passed through the arc, and the hardness was obtained by adding a hardening powder as the work was being done. With regard to special track work, when the author wrote his book on permanent-way work, electric welding was hardly known, but since then it had enabled tramway engineers to build their own points and crossings, and he expected it was entirely a question of economy which had induced the author to raise this point.

Mr. HOLT, briefly replying to the discussion, said he had never done any electric welding with manganese steel rods. As to the length of the arc, he had heard experts say that more carbon was liable to be carried over the shorter arc. With regard to the greater wearing properties of rails made years ago, those were made with more regular heats than was now the case; but if tramway authorities were prepared to pay the price, they could have a better article. The whole trouble was one of first cost. Similarly, since he wrote his book conditions had changed very materially. There were tramways now without any money at all, and if the makers hoped to sell points and crossings they must be made very much cheaper; unless these things were made cheaper tramways would go out altogether. He believed a satisfactory 10 ft. point could be made to take fish plates. He knew of important tramway undertakings which were building important junctions, and by the aid of welding were able to make a very much cheaper job than formerly. Therefore, unless Sheffield turned out cheaper stuff it would find someone else taking the business from it. If a softer metal was used, it would not be possible to harden it by any exothermic method afterwards. A deeper groove was necessary, and if the Standards Association did not take this mater in hand, tramway engineers would find a way of settling it themselves.

*(To be concluded.)*

## THE "EDISWAN" HOUSE-WIRING SYSTEM.

THE subject of house wiring is of so much importance that every means by which the work of installation can be cheapened calls for careful scrutiny, and we were pleased to have the opportunity, last week, of inspecting a new system devised by Mr. F. C. Raphael, manager of the cable and wiring department of the Edison Swan Electric Co., Ltd. The essence of this system is simplicity, which is attained without loss of other desirable qualities, and it is claimed that its use will result in economy of time and labour, that it can be

FIG. 1.—BONDING RING.

installed satisfactorily by workmen who are not highly skilled, and that it offers little scope for bad workmanship.

The cable used presents no special features of novelty, being of the 600-megohm class, rubber insulated, and sheathed with metal alloy, flexible enough to allow of sharp bends, but stiff enough to be fixed with clips without sagging; it is supplied single or twin, the conductors in the latter case having tapes of different shades and the sheathing being of flattened section.

The standard sizes range from 0.044 in. diameter to 3/20 S.W.G., and the cable is dispatched on small drums, each containing 110 yards.

The characteristic feature of the system is the bonding ring (fig. 1), for the purpose of connecting together the metal sheathings of the cables at ceiling roses, switches, and other fittings. It consists of a ring of soft tinned brass in which there are four slots, the sides of which are formed so as to allow the metal-covered cable to pass through. The outer and

FIG. 2.—THREE-WAY WOOD BLOCK.

inner diameters of the bonding ring are the same as the outer and inner diameters of the wood block (fig. 2) and the blocks are provided with grooves to fit the bonding ring and cable. When the block is screwed down in the ordinary manner, the cable is gripped on both sides by the bonding ring, and perfect electrical contact is made. No small screws and nuts are required, the necessary bonding is obtained simply by screwing down the wood block by means of the usual wood

FIG. 3.—BLOCK AND RING.

screw through its centre (fig. 3). It is always possible, when inspecting the completed work, to see whether the bonding ring has been properly inserted, as the edge and the turned-up portion are visible at the sides of the block.

In the case of back entry, a wing of lead is turned back from the cable and inserted in the slit in the bonding ring from the inside, a plain block being then used, which presses the lead and the ring into intimate contact when screwed

FIG. 4.—JUNCTION BOX.

home. Both side and back entry cables can be bonded under the same block. The bonding ring is "universal," any ways not utilised being pressed flat when the block is screwed home.

The wood blocks, for which patent rights are being obtained, are supplied ready grooved for the cable, in imitation walnut and white enamel finishes, 3¼ in. in diameter outside, 2⅛ in. inside, and 1 in. thick. As the bonding ring occupies no space inside the block, the whole of the interior is available for slack cable. A "universal" 4-way block alone need be stocked, as all the ways need not be occupied, but blocks with one, two, or three ways are also supplied. To prevent any

possible damage to the slack cable by the centre screw, an insulating bush may be slipped over it—but this is not really necessary.

The "Ediswan" junction box is made in the form of a universal 4-way box (fig. 4); it consists of a heavy iron backplate, a bonding ring, a porcelain connector, and a stout stamped iron cover, painted grey. The backplate is screwed to the wall by a screw through the centre; the cables are then passed through the bonding ring and connected as desired with a porcelain connector, and the cover is fixed on with

FIG. 5.—BONDING STRIP.

four screws. The parts can also be used in other combinations.

Where cables enter a distribution box, they are clamped between a thick iron backplate and a thin tinned brass strip, which ensures perfect contact (fig. 5). The earthing wire can be clamped under the brass strip, but is preferably soldered thereto. Bonding strips for 2, 3, and 6 ways are available.

One of the neatest features of the "Ediswan" system is the method of supporting the cable. The "cable fixer" is of

FIG. 6.—CABLE FIXER AND CAP.

lead strip, which is bent round the cable; the punched ends are fitted into a bronzed cap (fig. 6), and the clip thus formed is nailed or screwed to the wall or ceiling (fig. 7). The cable is thus securely held without risk of injury, there are no projecting ends of metal, and the time expended is a minimum. The standard fixers will take two single cables or one twin cable. Where a larger number of cables is to be dealt with, lead strips can be cut to a suitable length.

Special attention has been given to the packing of the components in boxes containing convenient numbers, saving

FIG. 7.—CABLE FIXED.

space and preventing damage to the parts. For example, a box of cable fixers contains 144 caps, 100 straps, and 10 ft. of lead strip.

Every detail of the "Ediswan" wiring system, it is claimed, conforms with the I.E.E. Wiring Rules. It is certainly very neat and effective, with the minimum of special parts, and requires no special tools at all. Hence the claim that the system is characterised by extreme simplicity is justified. The whole of the parts described are made by the company, and a great deal of ingenuity and foresight has obviously been expended upon their design.

## CORRESPONDENCE.

***Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.***

### Competition in the South American Market.

I have read your leader in the current issue of your paper *re* "Competition in the South American Market" with considerable interest, and generally the writer can, after 12 years' experience of South America, confirm your remarks.

The reasons why the German trade is so successful in the South American Republic are:

(1) Because, whilst individual firms and industries are apparently separately represented, actually they are (unofficially perhaps) under the control of a guiding representative of a central authority, who controls large groups of industries.

(2) They conform to the business customs of the countries.

With regard to the first point, the remedy is for groups of British manufacturers to come together and, whilst not necessarily altering the personnel of their present representatives, they must appoint a strong reliable man to act as their united representative, who must be *persona grata* with the Government and Municipal powers of the country. The present local representatives must keep in close touch with him and discuss any business, at any rate, of an important nature with him, before tendering.

Details as to the wisdom and reasons of such an appointment can only be given at an interview, but matters such as guarantees, obtaining payments and especially final payments, are points that would come within the ambit of the duties.

At any rate, with a representative of such a nature, and with adequate powers, there is no reason why the majority of any business going should not be obtained for Great Britain, especially when it is borne in mind that British goods and workmanship have a reputation for good quality as an asset to start with.

Under the second point, the objection often made as to British weights and measures and money values causing a loss of trade is of little importance; actually it may be and, no doubt, often is, given as the official reason for turning down a proposition, but it carries little weight. The writer can give a very much more pertinent cause for such rejections. Don't forget that the £1 sterling is known throughout these countries and its value thoroughly well known, and it is value that talks in the long run. For instance, with sovereigns in one's pocket one can travel throughout most South American countries and receive nominal exchange for them at almost any shop at which he may make a purchase. The writer has done it on more than one occasion just to prove this contention; no other country's gold can be so used. It is not meant that catalogues, letters, &c., should not be made out in the language and weights and measures of the countries under review; the writer considers this to be of great importance, but still is of opinion that it is of more importance to transact business in accordance with the customs of the countries as this carries the most weight. Obviously, details cannot be discussed in an open letter of this nature.

To illustrate the point, a group of companies could be made for, say, railway work, comprising firms making in a large way—Structural steel shapes; corrugated iron sheets; water tanks; artesian well pipes and tools; windmills and pumps; hydraulic cement; rails; points, crossings and special work; bolts, nuts, tie bars, &c.; signalling apparatus, mechanical, electrical and automatic; carriages and wagons; locomotives; workshop tools, both for iron-working and wood-working, and some less important but necessary trades.

When considering the above, do not conclude that because a lot of the railways are financed by British capital and managed by British men and because business with such railways can be negotiated in London, the above combination is not necessary. It must not be overlooked that there are a lot of Government railways, as well as other railways, financed by other countries, principally France, as well as a considerable mileage of railway of a semi-private nature.

Again, with regard to the electric supply industry, a combination should be formed between makers of boilers and superheaters, economisers, steel chimneys, reciprocating engines, turbines, generators, condensers, economisers, pipes, switch and controlling gearing, transformers, rotaries, motor generators and motors, instruments, meters, cables, earthenware ducts, feed and circulating water pumps, workshop and machine tools, other necessary details from other groups, such as structural steel shapes, and so on.

The above list does not pretend to be complete, but is only indicative of the idea advanced.

The percentage each section should bear of the expenses of running the type of representation suggested could readily be arrived at by a round table conference.

Llanelly, **J. E. Stewart, M.Inst.C.E.**
*July 12th*, 1921.

### Charges for Service Mains.

Your correspondent, July 8th issue, who writes about "holding up wiring contracts, to the benefit of gas companies," would do well to first find out what the latter would charge.

I have recently negotiated two contracts for running service mains for electric power and gas for furnace heating, and under similar conditions the cost of the gas connection is certainly the heavier of the two.

Your correspondent who signs himself "Disgusted" must realise that owing to the difference in money values and the consequent difficulty in obtaining capital, it is only reasonable that public utility companies should demand the cost of these connections.

**F. S. Paterson,**
London, *Consulting Engineer.*
*July 14th*, 1921.

### Armature Core Bands.

With reference to "Armature's" letter in THE ELECTRICAL REVIEW of July 1st, I had similar trouble with an armature of a motor direct coupled to a centrifugal pump, running at 2,000 r.p.m. The "core bands" kept spreading after a run of 6 or 7 hours, while the heavy end bands remained perfectly intact.

The spreading and bursting of the core bands obviously allowed coils to rise and strike the pole shoes, causing a serious "shut down."

The windings were speedily repaired and new bands put on; this time I put on double bands. The five single core bands of No. 18 S.W.G. wire were first put on and sweated up; then second bands of No. 22 S.W.G. were wound between the turns of the first—both bands were clipped at every fifth tooth, and sweated up solid. This gave a more solid band—the contact area for solder being considerably increased. The new arrangement proved O.K.

**J. J. P. C.**

*July 11th*, 1921.

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### Correspondence re the E.P.E.A.

I, too, am not a member of the E.P.E.A., but I should be obliged for a little space in your columns in order to reply to Mr. Dorey's letter in last week's REVIEW.

In the first instance, I should like to point out to Mr. Dorey that the very principle he is opposing is the ideal at which employer and union alike are aiming, namely, arbitration, in place of direct-action methods. He also points out that the "Grousers'" letters tire him—which is indeed a great shame—but he, perhaps, forgets that his recent continual stream of arguments with regard to the measurement of kVA greatly tired myself and many of my confederates in the supply industry.

Mr. Dorey's contemptuous letter is undoubtedly an insult to the long and hard efforts of the E.P.E.A., whose well-fought battles have brought about such splendid results on behalf of the previously ill-paid electricity supply operatives.

With great pleasure I give both my name and address for publication.

**L. T. C. Russell.**

Springsmire Power Station,
Dudley, Worcestershire.
*July 12th*, 1921.

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### Village Electricity Supply.

I beg to enclose cuttings with reference to a proposed village electricity supply which is under consideration at Kingussie, in the Highlands. This scheme is to be burdened with the expense of getting a Provisional Order. Why is this necessary? The local Council is to carry through the installation. Many villages in this part of Scotland, possessing water power at present doing nothing, are likely to have paraffin as an illuminant for many years yet, through obstacles of one kind or another. As for electricity supply from these much-talked-of super-hydro stations for the whole of the Highlands, it is very doubtful whether this would be a paying proposition, as anyone who has a knowledge of this part of the country knows that there would be a considerable amount of overhead mains passing through miles and miles of rough, rockbound country, where there would not be a single consumer of the current. The very severe winters in this district would involve costly maintenance of aerial cables.

**W. Winterburn,**
*Engineer.*

Aviemore, Inverness-shire.
*July 18th*, 1921.

[The Act of 1919 substituted "Special Orders" for "Provisional Orders," and was intended to facilitate the grant of such powers as are sought by the Kingussie Council; we think the difficulties suggested in the cuttings forwarded by our correspondent have been exaggerated somewhat.

An alternative course, which presents no difficulties, is to form a small company locally to supply electricity without statutory powers. Such a company would have a large measure of freedom, as explained in our issue of April 22nd, 1921, p. 511. Many installations of this kind are in existence in this country. —EDS. ELEC. REV.]

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### The Review of "Armature Winding."

I have just noticed your review of my book "Armature Winding," and I must say that it is not favourable to me at all. The only conclusion I can come to, since my work has generally been appreciated by readers of the ELECTRICAL REVIEW and other journals of the technical Press, is that you must have received a copy of the book which does not contain an errata slip.

In explanation of this, I desire to point out that the last proofs were checked on the eve of my departure for the West Indies, so that I did not really have an opportunity of checking final proofs. When I received a copy of the book at Kingston, British West Indies, some weeks after its publication, I detected a number of errors, and I at once informed Mr. Rentell, who had slips printed and inserted in the book. I, personally, had a slip typed and sent to the secretary of the Institution of Electrical Engineers, to whom I knew a copy had been sent, because I had already received an acknowledgment of it.

The first edition of this book is almost sold out, and I am now engaged upon its revision. I desire to assure you that all errors will be entirely eliminated in the second edition. Moreover, I am adding several new features to the book which will make it a much more valuable asset to the armature winder. Thanking you for drawing my attention to some of the mistakes.

**Cyril Sylvester, A.M.I.E.E., A.M.I.Mech.E.**

Douglas, I.O.M.
*July 15th*, 1921.

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### Coal Shortage and Oil Fuel.

In reply to Mr. S. H. Fowles's letter, I stated that *at least* three times as much oil would be used under boilers; I had in my mind the results which were being obtained with boilers at the moment I wrote the letter, and the results I had obtained with a modern all-Diesel power house, containing engines of various makes. I could easily have said four times as much per kWh and still have been within the figures. My actual record for getting a boiler on the range, which had been properly banked with coal and with several oil burners fitted, is 22 minutes; this was only done because of necessity and not because it improved the condition of the boiler. I don't think Mr. Fowles will beat 20 minutes by a big margin. The actual time to get a Diesel on load depends to a great extent on the number of cylinders and the weight of the flywheel; I had a special low-speed traction set once which took about a minute, but an emergency set in the same station would run up in a very few seconds, although it had fewer cylinders.

With regard to Indian native crews of ships, many of them can drive Diesels and they can be satisfactorily trained in this work in a very short space of time, seeming to have a natural liking for it, as there is no coal trimming or other work distasteful to them. So far as English-made Diesels are concerned, I have noticed that they vibrate more than they should, and I have seen quite a number of them giving trouble, mainly due to vibration and sluggish running. I own up to having ill-treated one Diesel engine, continuously for four years or so during the war, and although at the time about 18 years of age, and suffering from permanent defects, due to a premature birth, it was running better at the end of the time, and capable of taking a bigger overload than when it was first overloaded. If there are any points of practical value in connection with Diesel engines I should be glad at any time to discuss them; the scientific aspect of the problems seems to be well established, and the advantage of exhaust boilers and feed heaters is now recognised, as is the fact that the hot circulating water may also be of value. The trouble seems to be an operation difficulty, which I myself have yet to discover, but which has set the "powers that be" quite against this type of prime mover.

**Junior Charge Engineer.**

*July 18th*, 1921.

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### A Mysterious Occurrence.

With reference to the mysterious earth lamp trouble which is puzzling "A. H.," I think if he looks a little closer into the matter he will find it not so mysterious after all.

The most probable cause of it is in a faulty field coil of a motor which is flashing a large back voltage to earth.

It may arise from insulation faults in coils such as a solenoid or a lifting magnet, but at any rate I think he will be certain to find it is an induced current of high voltage.

It frequently happens in steelworks practice, and as a cure for the damage to the earth sets I would suggest putting another lamp of the same voltage (220) in the earth wire, which will give the necessary result. The difference is that during a dead earth, instead of one full light showing, the earth lamp will show a half and one of the mains a half. In the case of the excess voltage I have mentioned, the two lamps have a better chance of standing up to it until the cause of the trouble is located and removed.

I should be pleased to know if "A. H." finds my surmise to be correct in his case, or, if not, where he found the cause.

**Arthur Coates.**

Stockton-on-Tees.
*July 15th*, 1921

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### Short-range Sea Horizons for Cable Ships.

With reference to the letter of Capt. Campos, I would suggest that a range finder greatly facilitates the use of a short-range sea horizon.

H.M. telegraph ship *Alert* is fitted with a 9-ft. Barr & Stroud range finder. By utilising the astigmatic lens the distance of a flare or light can be obtained at night with great accuracy at the moment of observation, whether the ship be stopped or moving.

In the North Sea, where good horizons are rarely obtained, excellent results have been obtained by using the lighted mark buoy in conjunction with the range finder.

**Walter H. Leech,**
*Third Officer.*

H.M.T.S. *Alert*,
*July 15th*, 1921.

## NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

**Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.**

17,931. "Electrical apparatus for indicating and repeating movements at a distance." J. L. Routin. July 1st.
17,933. "Electric starting and igniting apparatus." Scintilla. July 1st. (Switzerland, July 1st, 1920.)
17,936. "Electric generators and motors." T. S. Jones. July 1st.
17,941. "Drives for paper machines, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). July 1st.
17,942. "Electric measuring instruments." A. S. Cubitt. July 1st.
17,943. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co.). July 1st.
17,944. "Electric conductors, and method of insulating same." British Thomson-Houston Co., Ltd. (General Electric Co.). July 1st.
17,947. "Telephone call boxes, &c." W. Clark and Clark's Neo-Electric Devices, Ltd. July 1st.
17,958. "Electro-magnetic and polarised relays." T. Lenaghan. July 1st.
17,959. "Telephone switch banks." Creed & Co., Ltd., and T. Lenaghan. July 1st.
17,960. "Automatic telephone systems." Creed & Co., Ltd., and T. Lenaghan. July 7th.
17,961. "Thermostatic relays." T. Lenaghan. July 1st.
17,997. "Manufacture of electric cables." Callender's Cable & Construction Co., Ltd., and J. Urmston. July 2nd.
17,998. "Electric switch gear." Callender's Cable & Construction Co., Ltd., and C. W. Kay. July 2nd.
18,007. "Control of electric motors for cranes, &c." D. Adamson, W. Brook, and E. Holme & Co., Ltd. July 2nd.
18,017. "Supports for electric light holders." W. Barnett, B.S.T. Electric Fittings Co., F. Saunders, and P. J. Thompson. July 2nd.
18,030. "Package or container for incandescent electric lamps, &c." H. C. Lovell. July 2nd.
18,032. "Electrically-heated clothing." A. Negromanti. July 2nd. (Italy, December 18th, 1920.)
18,037. "Electric instruments and relays." R. H. Barbour and A. J. Martin. July 2nd.
18,044. "Process of treating light rays, cathode rays, Rontgen rays, &c." R. Bengough. July 2nd. (Austria, July 3rd, 1920.)
18,067. "Electric switches." H. S. Cooke and A. G. Sutherland, Ltd. July 4th.
18,075. "Fuse-boxes for electric cables." R. A. Macaulay. July 4th.
18,080. "Electric cables and insulators." G. H. Hosie. July 4th.
18,082. "Electric protective apparatus." C. C. Garrard, A. H. Railing and W. Wilson. July 4th.
18,086. "Masts for supporting overhead electric transmission lines, &c." G. V. Twiss. July 4th.
18,091. "Electric immersion heater." C. W. Slark and F. M. Steele. July 4th.
18,093. "Systems of long-distance telephony." Naamlooze Vennootschap Nederlandische Thermo-Telephoon Maatschappij. July 4th. (Germany, July 5th, 1920.)
18,097. "Transmission dynamometers." F. Krupp Akt.-Ges. July 4th. (Germany, November 10th, 1920.)
18,108. "Electric supply services for dwelling-houses." E. S. Russel. July 4th.
18,109. "Cathodes for electrolysers." J. F. Webb. July 4th.
18,112. "Electric current-collectors." P. H. Brown, Morgan Crucible Co., Ltd., and C. Y. Knight. July 4th.
18,122. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 4th. (United States, July 3rd, 1920.)
18,125. "Dynamo-electric machines." F. Newton. July 4th.
18,126. "Cleaning discharge electrodes in apparatus for electric precipitation of suspended particles from gases." Lodge Fume Co., Ltd. (Metallbank und Metallurgische Ges.). July 4th.
18,127. "Mechanically rectifying polyphase current." Lodge Fume Co., Ltd., (Metallbank und Metallurgische Ges.). July 4th.
18,138. "Safety spring accumulator case." S. Trench. July 5th.
18,145. "Self-driving, &c., electric motors, generators and transformers." A. E. W. Maseyk. July 5th.
18,171. "Supports for electric lamps." S. Preston and H. Wilkinson. July 5th.
18,185. "Sparking-plugs." M. L. Parsons. July 5th.
18,215. "Methods of coating reflectors, &c., with liquid enamel, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). July 5th.
18,216. "Electric induction apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). July 5th.
18,217. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (Compagnie Francaise Thomson-Houston). July 5th
18,218. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and J. Martin. July 5th.
18,219. "Electric equipment of aircraft." A. L. Davis. July 5th.
18,226. "Induction electric motors." G. H. Fletcher, Metropolitan-Vickers Electrical Co., Ltd. July 5th.
18,227. "Electric transformers, reactance coils, &c." Metropolitan-Vickers Electrical Co., Ltd. July 5th. (United States, July 20th, 1920.)
18,235. "Safety clip for plug-testing on motor-cycles." L. W. Appleton. July 6th.
18,236. "Electric transmission." A. M. Taylor. July 6th.
18,241. "Means for controlling feed or transversing material in electric welding machines." H. J. Preasey. July 6th.
18,248. "Electric indicator movements." I. H. Parsons. July 6th.
18,267. "Sparking plugs." W. Pickard. July 6th.
18,271. "Levers of brake rigging of electric tramcars and trailers." J. P. Barker. July 6th.
18,277. "Combined electric cable receiver and grip." A. E. Baxter. July 6th.
18,295. "Telephone circuits." D. A. Christian and Siemens Bros. & Co., Ltd. July 6th.
18,296. "Hunting arrangements in telephone systems." J. E. Collver, E. A. Petithory and Siemens Bros. & Co., Ltd. July 6th.
18,297. "Clamps for electric junction boxes for bonding metallic sheathed wires, &c." S. E. R. Beecroft, G. S. Boothroyd and Callender's Cable & Construction Co., Ltd. July 6th.
18,298. "Manufacture of electric wires or cables." V. T. Burchall and Callender's Cable & Construction Co., Ltd. July 6th.
18,311. "Sound amolifiers." A. E. Stebbing. July 6th.
18,322. "Lighting fixtures." British Thomson-Houston Co., Ltd. (General Electric Co., Ltd.). July 6th.
18,342. "Keyboard perforators for punched tape for automatic telegraphy." F. G. Creed. July 6th.
18,349. "Commutator dynamo-electric machines." Metropolitan-Vickers Co., Ltd. July 6th. (United States, July 30th, 1920.)
18,358. "Distant control device for electric circuits." P. Nouvel. July 6th. (France, August 12th, 1920.)
18,363. "Electric storage batteries, &c." I. E. Kohlmeyer. July 6th.
18,364. "Outside containers or boxes of electric storage batteries, &c." I. E. Kohlmeyer. July 6th.
18,372. "Accumulators or secondary batteries." T. S. L. Mann. July 6th.
18,393. "Electro-mechanical rope safety grip for hoists, &c." C. H. Marsden. July 7th.
18,430. "Safety devices for preventing over-heating of electric flat irons, &c." F. Richter. July 7th. (Switzerland, July 26th, 1920.)
18,446. "Car control equipments." British Thomson-Houston Co., Ltd. (General Electric Co.). July 7th.
18,458. "Electric accumulators." Chloride Electrical Storage Co., Ltd., and H. Dean. July 7th.
18,464. "Strip for holding electric lamp holders in position." D. J. Evershed and W. W. Symper. July 7th.
18,466. "Motor controllers." Cutler-Hammer Manufacturing Co., and Igranic Electric Co., Ltd. July 7th.
18,467. "Apparatus for suppressing arcs." Cutler-Hammer Manufacturing Co., Ltd., and Igranic Electric Co., Ltd. July 7th.
18,474. "Electrically-heated ovens." H. H. Berry. July 7th.
18,475. "Electric radiators." H. H. Berry. July 7th.
18,498. "Cathode tubes." P. Dresla and W. Graaf. July 7th. (Germany, July 8th, 1920.)
18,525. "Instruments for measurement of electrical resistances." J. W. Record. July 8th.
18,530. "Candle-lamp holder." N. Zabban. July 8th.
18,541. "Telephone receivers operated by heat." L. B. Miller. July 8th.
18,546. "Hydrophones." A. Watkins. July 8th.
18,562. "Lanterns and casings for electric lamps, &c." R. K. Hearn. July 8th.

## PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

### 1919.

20,252. "Relay and radio receiving systems and the like." J. Scott-Taggart. August 18th, 1919. (Cognate application, 32,523, 1920, and 34,315, 1920. Patent of addition not granted.) (165,115.)
20,261. "Telephone intercommunication and like systems." W. P. Thompson (Compagnie Générale de Télégraphie et de Téléphonie). August 18th, 1919. (165,116.)
22,165. "Electric oil switches." Victoria Falls & Transvaal Power Co., Ltd., and B. Price. September 9th, 1919. (165,117.)
32,411. "System for the transmission of electro-radiant energy. F. A. Kolster. November 27th, 1916. (137,073.
32,415. "Method of and apparatus for the reception or transmission of electro-radiant energy. F. A. Kolster. January 30th, 1919. (138,318.)

### 1920.

1,587. "Electricity meters and the like." S. Z. de Ferranti, G. Wall, and Ferranti, Ltd. January 17th, 1920. (165,133.)
1,980. "Magnetic means for producing, modifying, and transmitting mechanical movements at variable speeds." H. J. Fereday. January 21st, 1920. (165,137.)
4,915. "Bonding clips for electric wiring systems." J. C. White. February 18th, 1920. (165,143.)
6,646. "Electrical measuring instruments." W. Clark and Clark's Neo-Electric Devices, Ltd. March 4th, 1920. (165,150.)
7,023. "Storage electric batteries." Philadelphia Storage Battery Co. September 5th, 1919. (150,985.)
7,024. "Storage electric batteries and separators for the elements thereof." Philadelphia Storage Battery Co. May 17th, 1919. (143,493.)
7,346. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). March 11th, 1920. (165,152.)
7,785. "Vacuum tubes." Western Electric Co., Ltd. (Western Electric Co., Inc.). March 16th, 1920. (165,157.)
7,941. "Reflectors for electric lamps." J. Y. Fletcher and J. H. Jones. March 17th, 1920. (165,165.)
8,174. "Electric meters for alternating currents." Azienda Elettrica Municipale. March 26th, 1920. (140,765.)
8,206. "Driving of aircraft." W. Chilton and Brush Electrical Engineering Co., Ltd. March 19th, 1920. (165,184.)
8,215. "Method and apparatus for utilising sound vibration for ascertaining distances." H. Fairbrother (Wireless Spitzescope Co.). March 19th, 1920. (165,185.)
8,242. "Locking devices for valves and electric switches used in connection with internal combustion and other engines." B. Skagen. March 19th, 1920. (165,187.)
8,625. "Portable electric lamps." C. E. P. Gabriel. March 24th, 1920. (165,211.)
8,683. "Thermionic devices." W. A. E. Quilter. March 24th, 1920. (165,217.)
8,693. "Condenser systems." British Thomson-Houston Co., Ltd. (General Electric Co.). March 24th, 1920. (165,218.)
8,799. "Condenser systems and vacuum pumps." Worthington Pump and Machinery Corporation. May 23rd, 1919. (143,841.)
8,807. "Protective devices for electric circuits and apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). March 25th, 1920. (165,227.)
9,673. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 20th, 1919. (149,936.)
11,255. "Electric double pole switching plug." H. C. Sanders. April 23rd, 1920. (165,272.)
11,618. "Call indicators for telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. Savin. April 27th, 1920. (165,275.)
11,748. "Means of supporting electrodes in vacuum tubes, especially for use in wireless telegraphy." J. Scott-Taggart, F. O. Read, and P. W. Englebach. April 28th, 1920. (165,279.)
11,777. "Electric distant control apparatus." Da & Dutilh (firm of). May 26th, 1920. (143,844.)
11,895. "Electrical condensers." H. W. Sullivan and J. Joseph. April 29th, 1920. (165,281.)
12,525. "Telephones." Relay Automatic Telephone Co., Ltd., and T. M. Inman. (Cognate application 4,301, 1921.) May 5th, 1920. (165,288.)
14,437. "Universal sound reproducer and arm." Brunswick Balke Collender Co. February 7th, 1917. (143,883.)
15,283. "Alternating current measuring instruments." S. James and Chamberlain & Hookham, Ltd. June 5th, 1920. (165,318.)
16,704. "Electric subterranean signalling systems." L. de Forest. June 16th, 1917. (145,476.)
18,892. "Electro-magnetic appliance for handling plates, rails, bars, and the like." D. Colville & Sons, Ltd., and J. J. Inglis. July 6th, 1920. (165,338.)
19,539. "Electricity meters." Korting & Mathiesen Akt.-Ges. April 2nd, 1917. (147,601.)
22,829. "Recording dynamometers." M. Rockstroh. August 4th, 1919. (149,687.)
23,906. "Permanent magnets for dynamo-electric machines." D. J. Pickee. August 16th, 1919. (150,273.)
25,679. "Field magnets for magneto-electric machines." Philips Akt.-Ges. September 6th, 1919. (150,739.)
34,208. "Electric switches." G. F. Ostins. December 3rd, 1920. (165,374.)

### 1921.

7,013. "Cooling of dynamo-electric machines." H. A. Carney and H. M. Lacey. April 22nd, 1920. (Divided application on 18,797, 1919.) (165,383.)
13,943. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). March 11th, 1920. (Divided application on 165,152.) (165,391.)
15,353. "Magnetic means for producing, modifying, and transmitting mechanical movements." H. J. Fereday. January 21st, 1920. (Divided application on 165,137.) (165,392.)